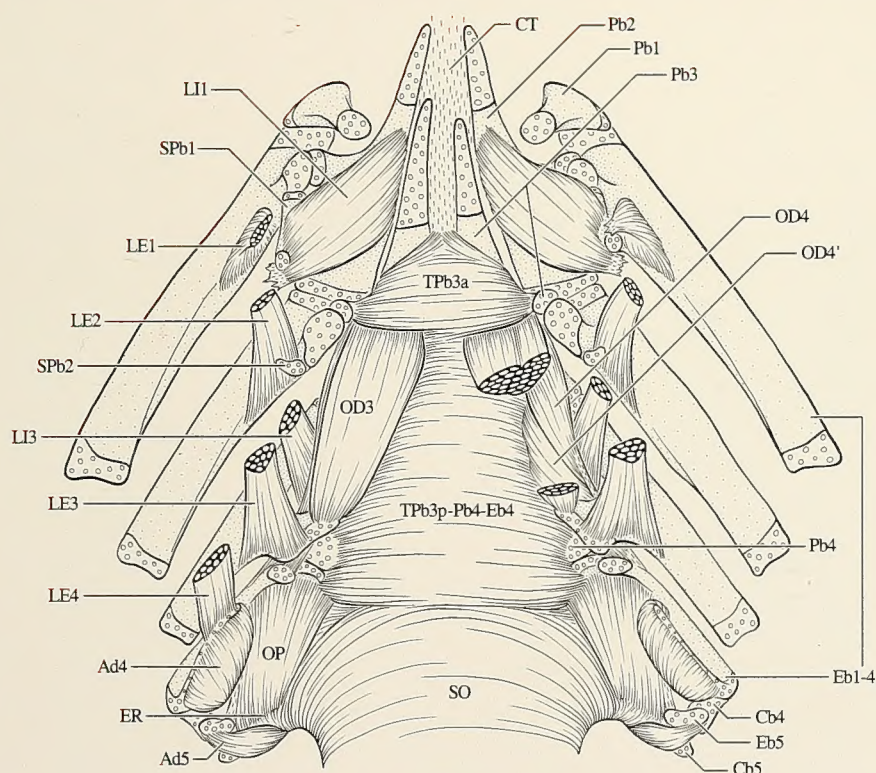


# BULLETIN OF THE BIOLOGICAL SOCIETY OF WASHINGTON



## PLATES

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Cover illustration: Dorsal gill-arch musculature of *Megalops cyprinoides*  
(see Plate 15).



# **STUDY OF THE DORSAL GILL-ARCH MUSCULATURE OF TELEOSTOME FISHES, WITH SPECIAL REFERENCE TO THE ACTINOPTERYGII**

Victor G. Springer and G. David Johnson  
Karolyn Darrow, Illustrator

## **Appendix: Phylogenetic Analysis of 147 Families of Acanthomorph Fishes Based Primarily on Dorsal Gill-Arch Muscles and Skeleton**

Victor G. Springer and Thomas M. Orrell

## **PLATES**

*"Art survives long after ideas go extinct—particularly if the art is good and the ideas less consistently so."*  
Joel Achenbach (2000), *Smithsonian Magazine*, 32(1):123.

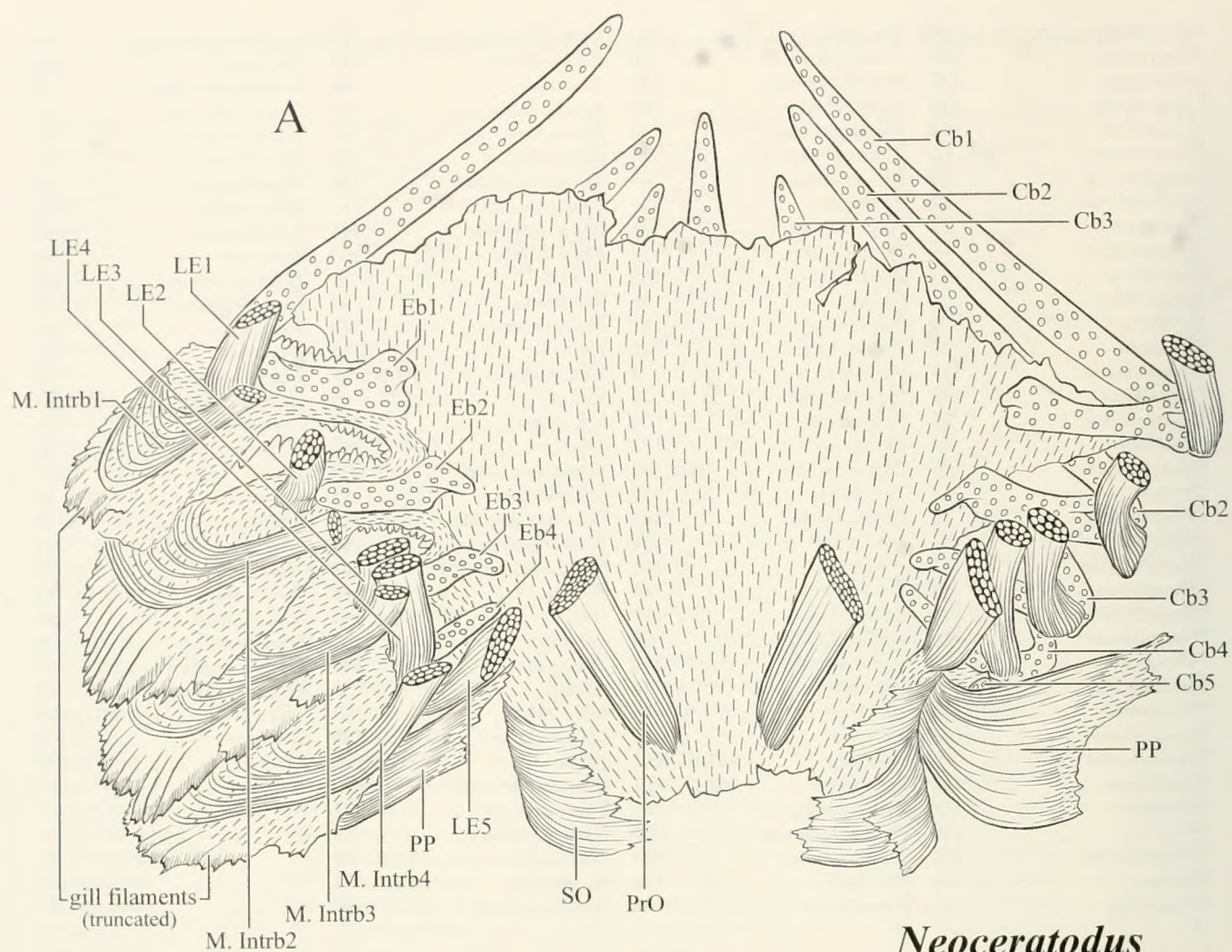
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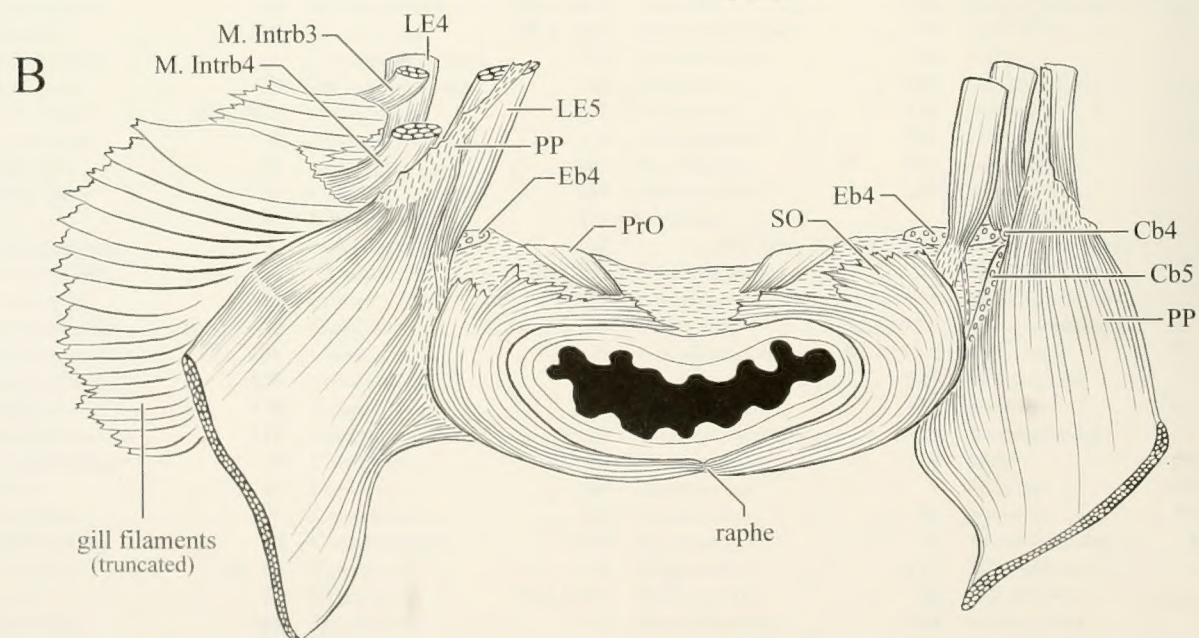
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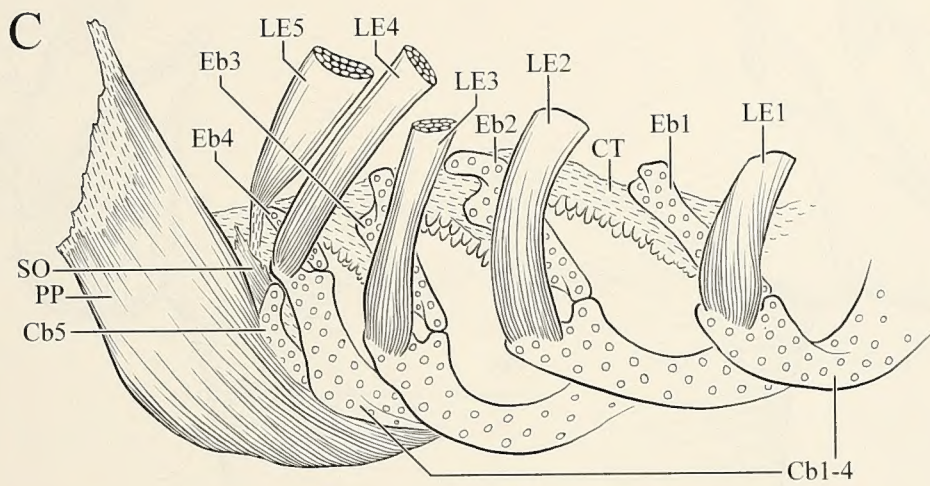
—2 mm—

***Neoceratodus***  
(Ceratodontidae)



Plates 1.1, 1.2. *Neoceratodus forsteri*, AMS I.40438001: A, dorsal view, SO damaged mid-dorsally, right-side Intrb1–4 and associated tissues removed; B, posterior view, right-side Intrb3–4 removed; C, right side, lateral view, Intrb1–4 and associated tissues removed.





*Neoceratodus*





B

*Polypterus*  
(Polypteridae)

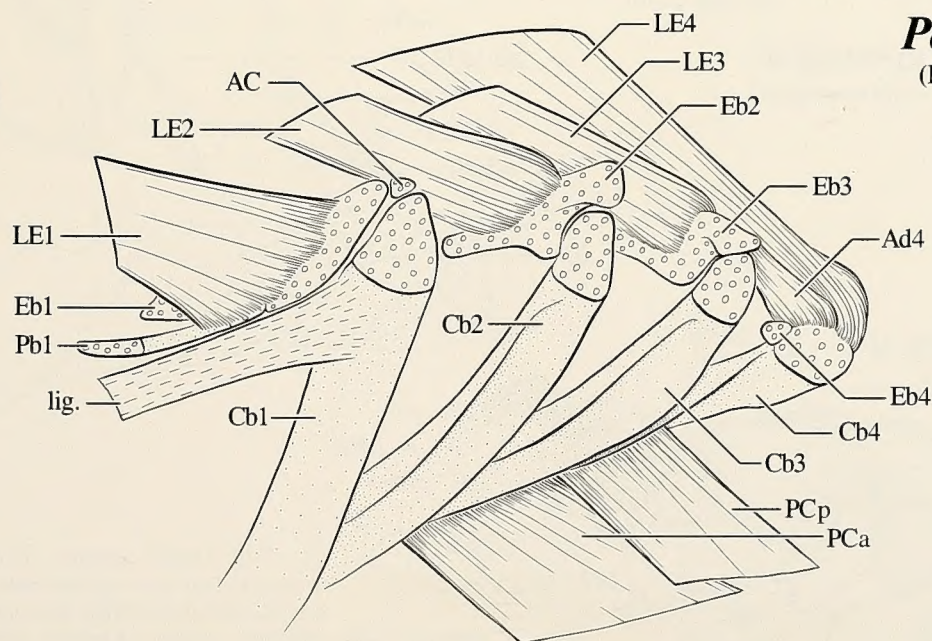
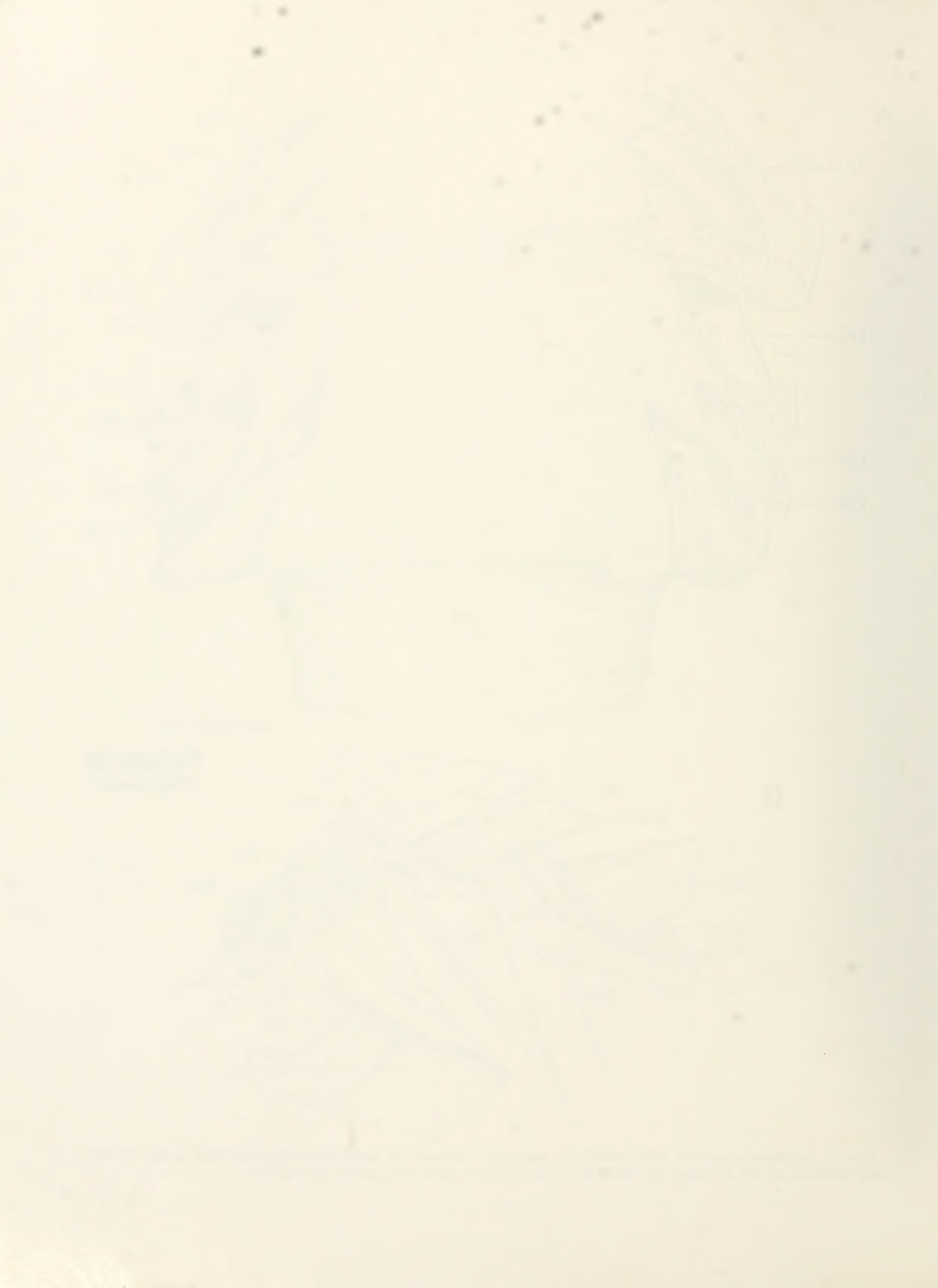


Plate 2. *Polypterus ornatipinnis*, USNM 164514: A, dorsal view; right-side Eb1 medial portion illustrated based on left side; note small ossification on Eb1; B, lateral view, right side reversed; note Cb5 absent, PCI and PCE attach to Cb4.





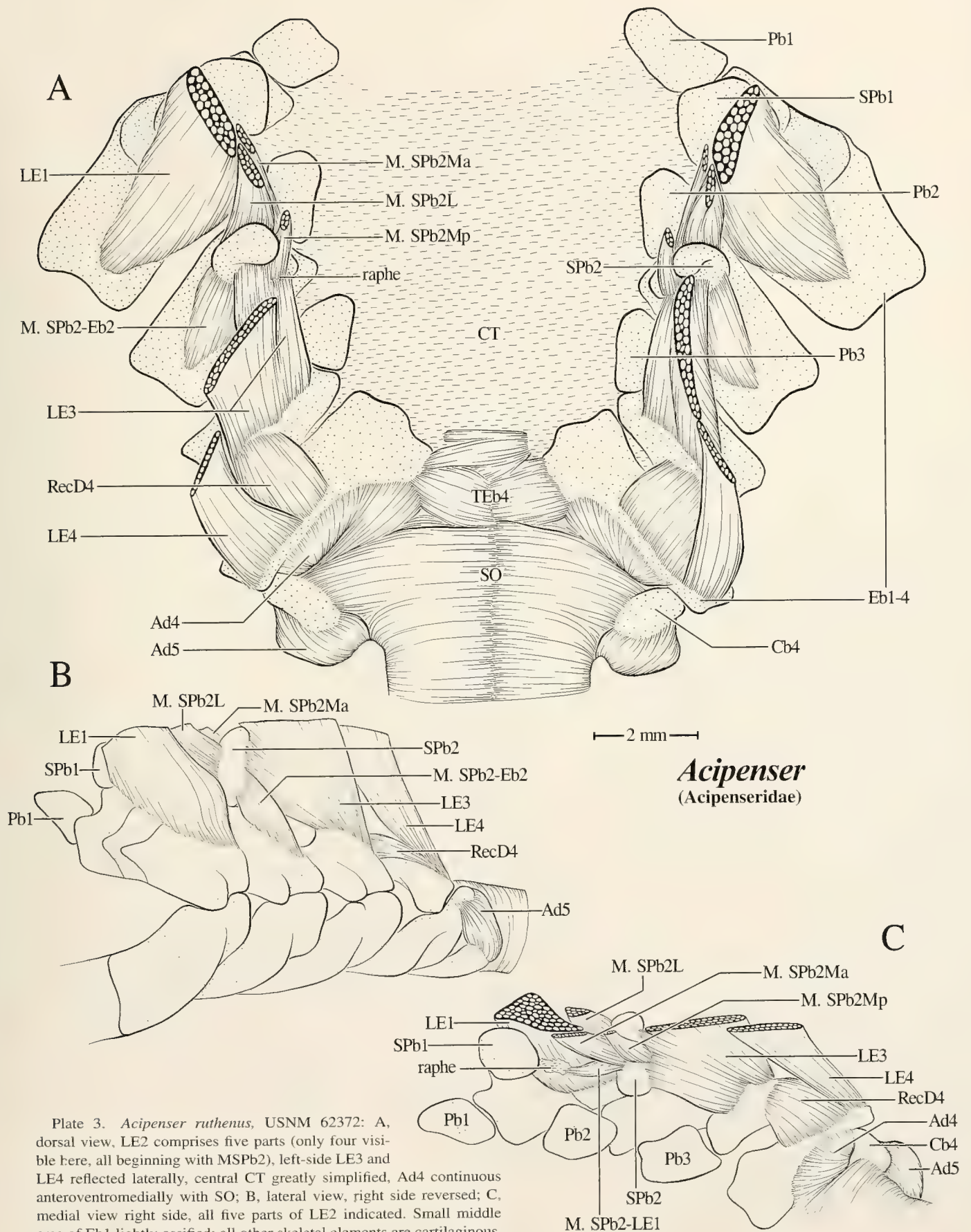


Plate 3. *Acipenser ruthenus*, USNM 62372: A, dorsal view, LE2 comprises five parts (only four visible here, all beginning with MSPb2), left-side LE3 and LE4 reflected laterally, central CT greatly simplified, Ad4 continuous anteroventromedially with SO; B, lateral view, right side reversed; C, medial view right side, all five parts of LE2 indicated. Small middle area of Eb1 lightly ossified; all other skeletal elements are cartilaginous.





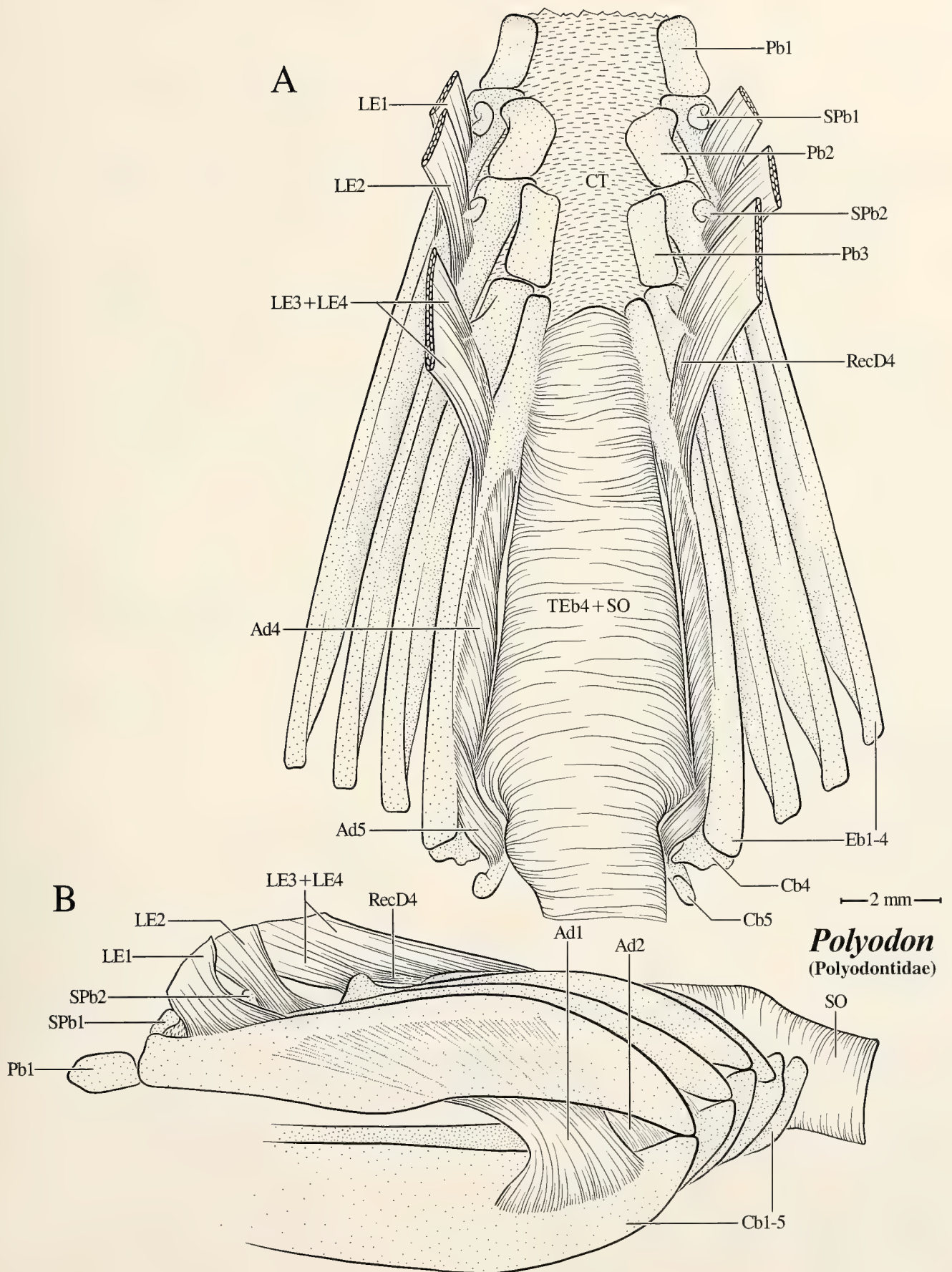
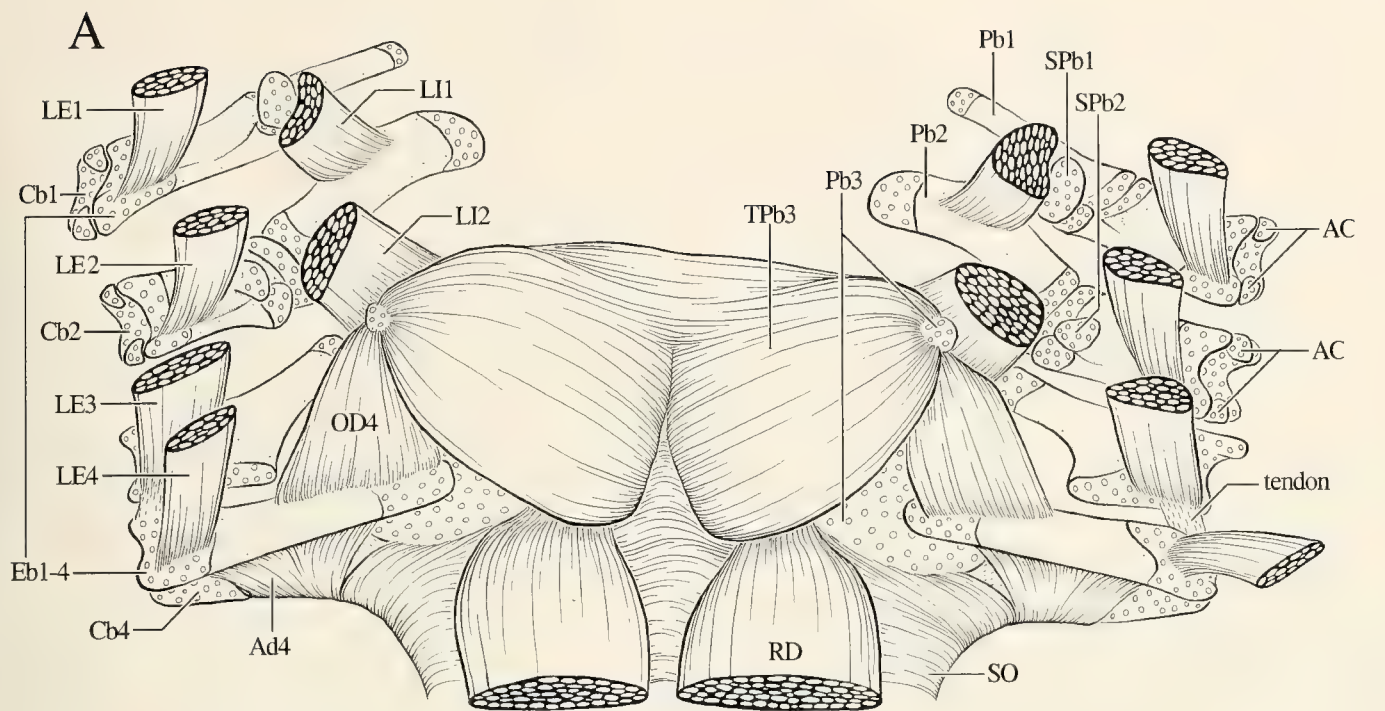


Plate 4. *Polyodon spathula*, USNM 101093: A, dorsal view; B, lateral view, right side reversed, dotted lines indicate extent of attachment of Ad1 to posterior surface of Eb1, similar Ads present on 2nd to 4th arches. All skeletal elements are cartilaginous.







*Atractosteus*  
(Lepisosteidae)

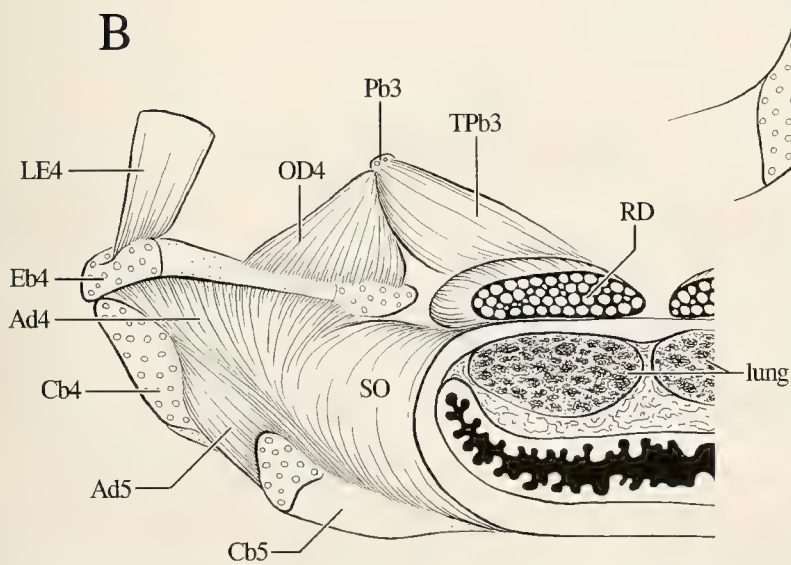
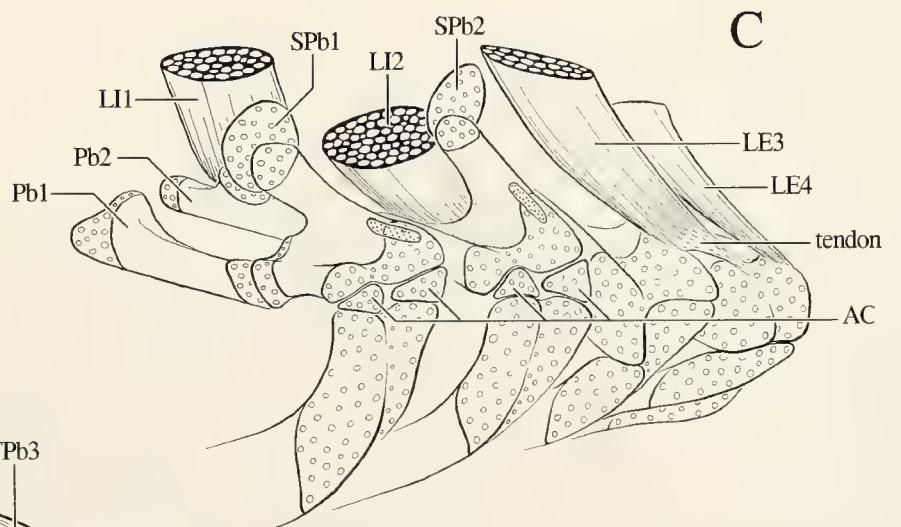


Plate 5. *Atractosteus tropicus*, USNM 120715: A, dorsal view, right-side LE4 retracted; position of LE2 insertion approximated (in B also); B, lateral view, left side; LE1 and LE2 removed (insertion positions indicated by shading); C, posterior view, right side reversed.





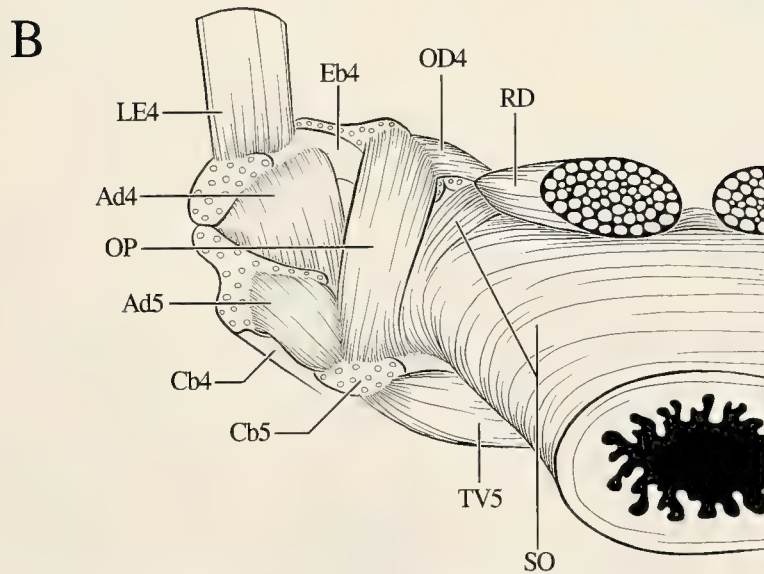
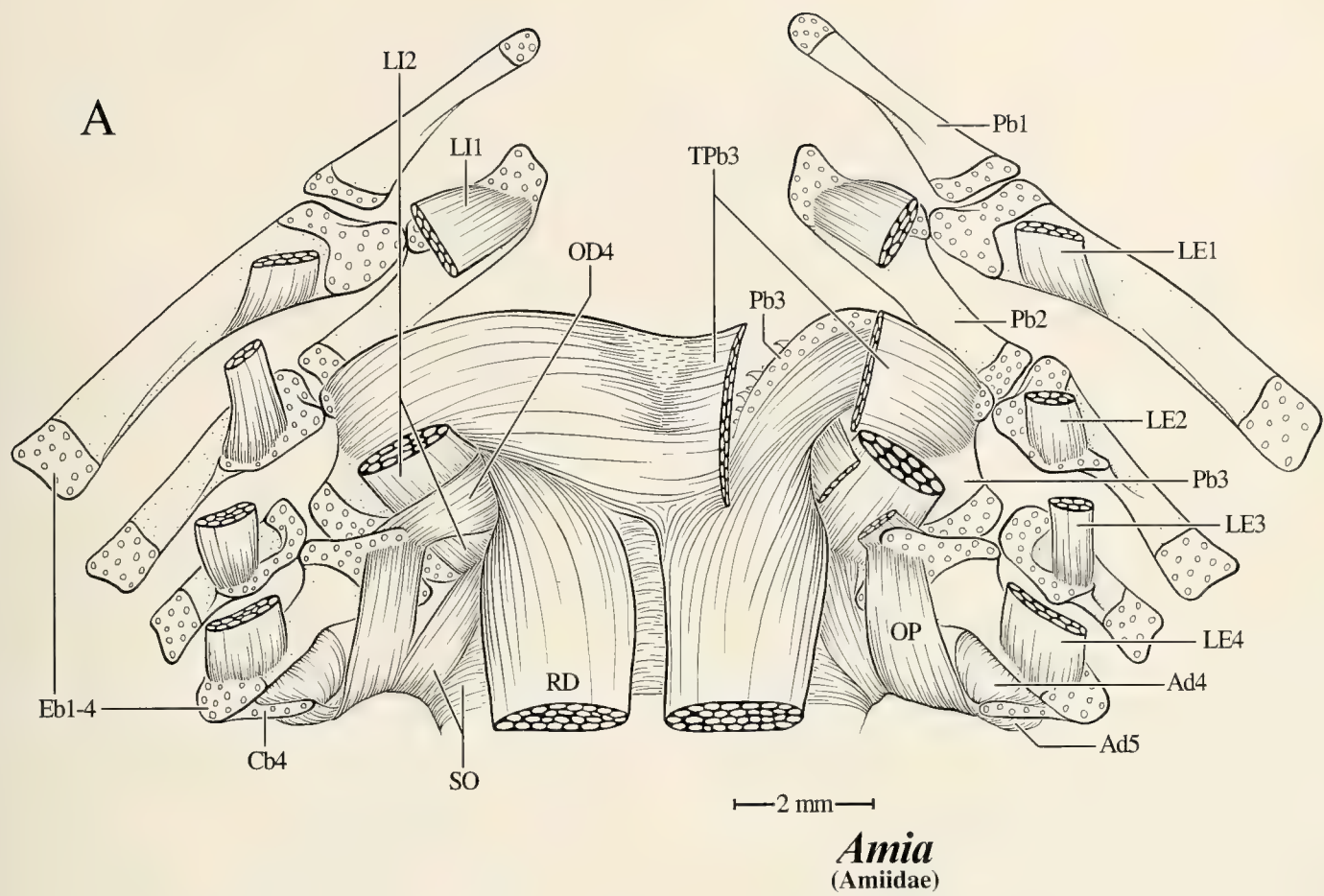


Plate 6. *Amia calva*, USNM 230909: A, dorsal view, right-side TPb3 and OD4 cut away; B, posterior view, right side reversed.





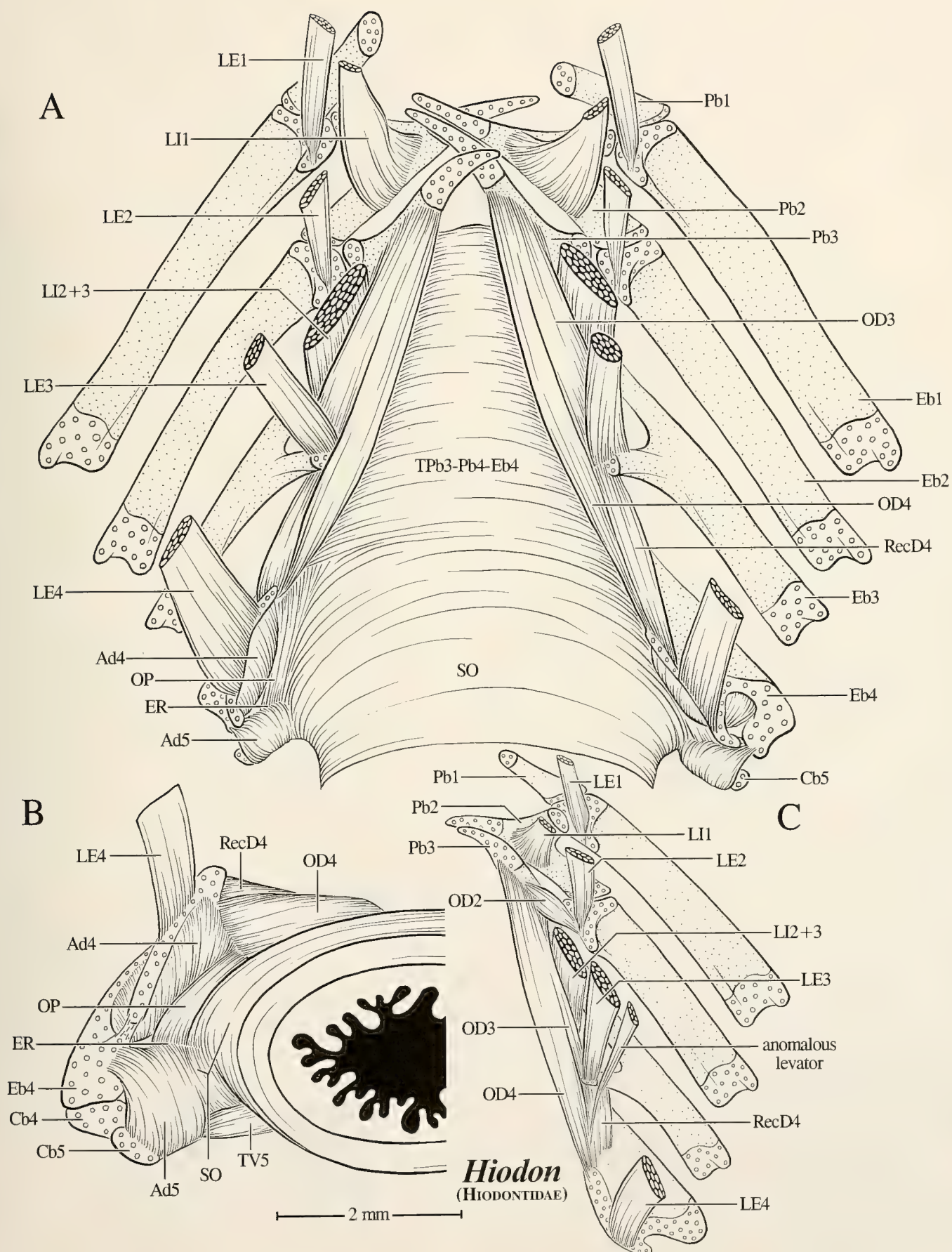


Plate 7. A, B, *Hiodon alosoides*, USNM 350554: A, dorsal view, distal (posterior) ends of Eb4s are rotated differently, making specimen appear asymmetrical and obscuring right-side OP; C, *H. tergisus*, USNM 342742, dorsal view, right side. See description and results sections for discussion of problems concerning identification of LI2 and/or 3.





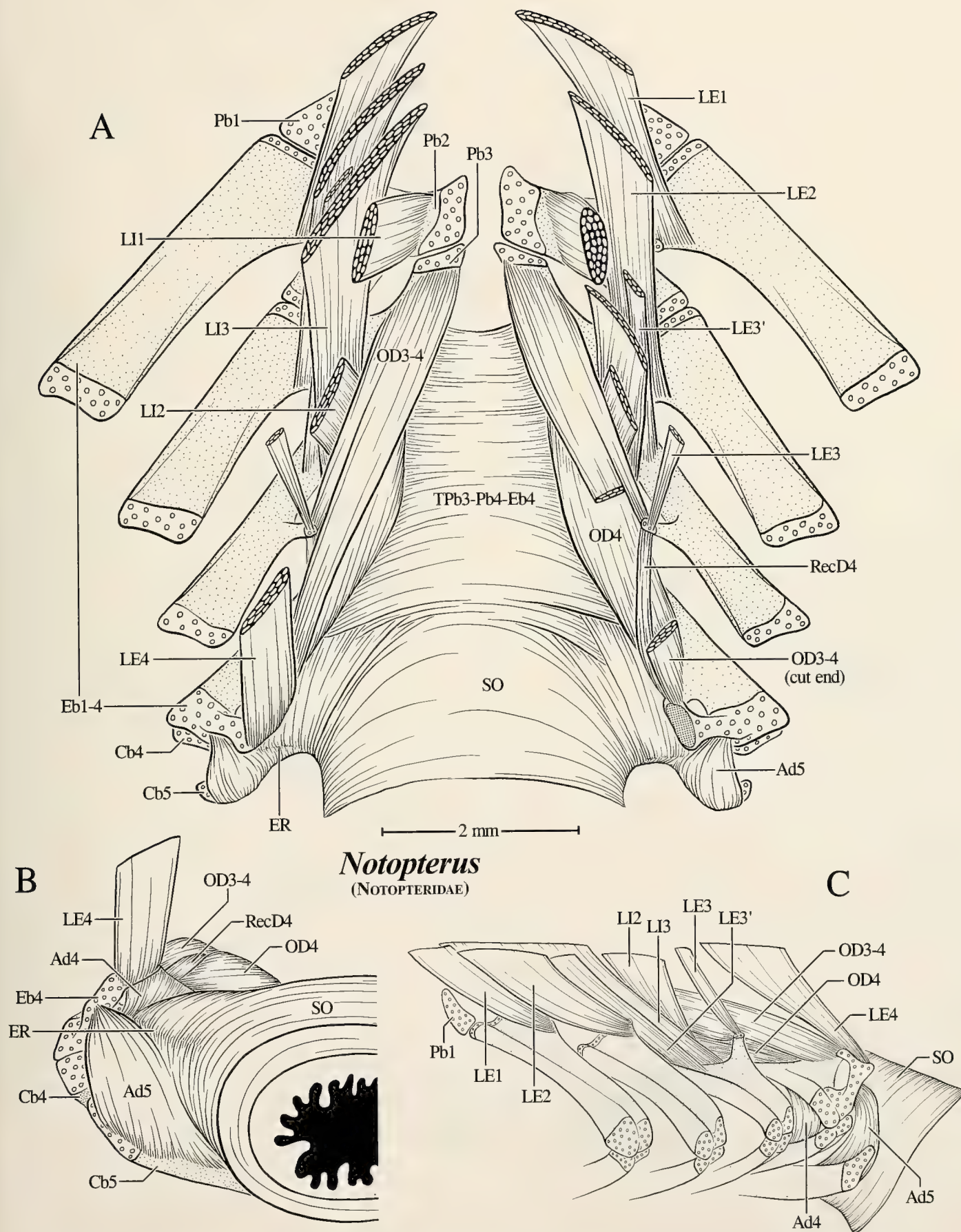


Plate 8. *Notopterus notopterus*, A, B, USNM 191464: A, dorsal view, right-side LE 4 removed and OD3-4 cut away to reveal RecD4; B, posterior view, left side; C, USNM 344674: lateral view, left side.





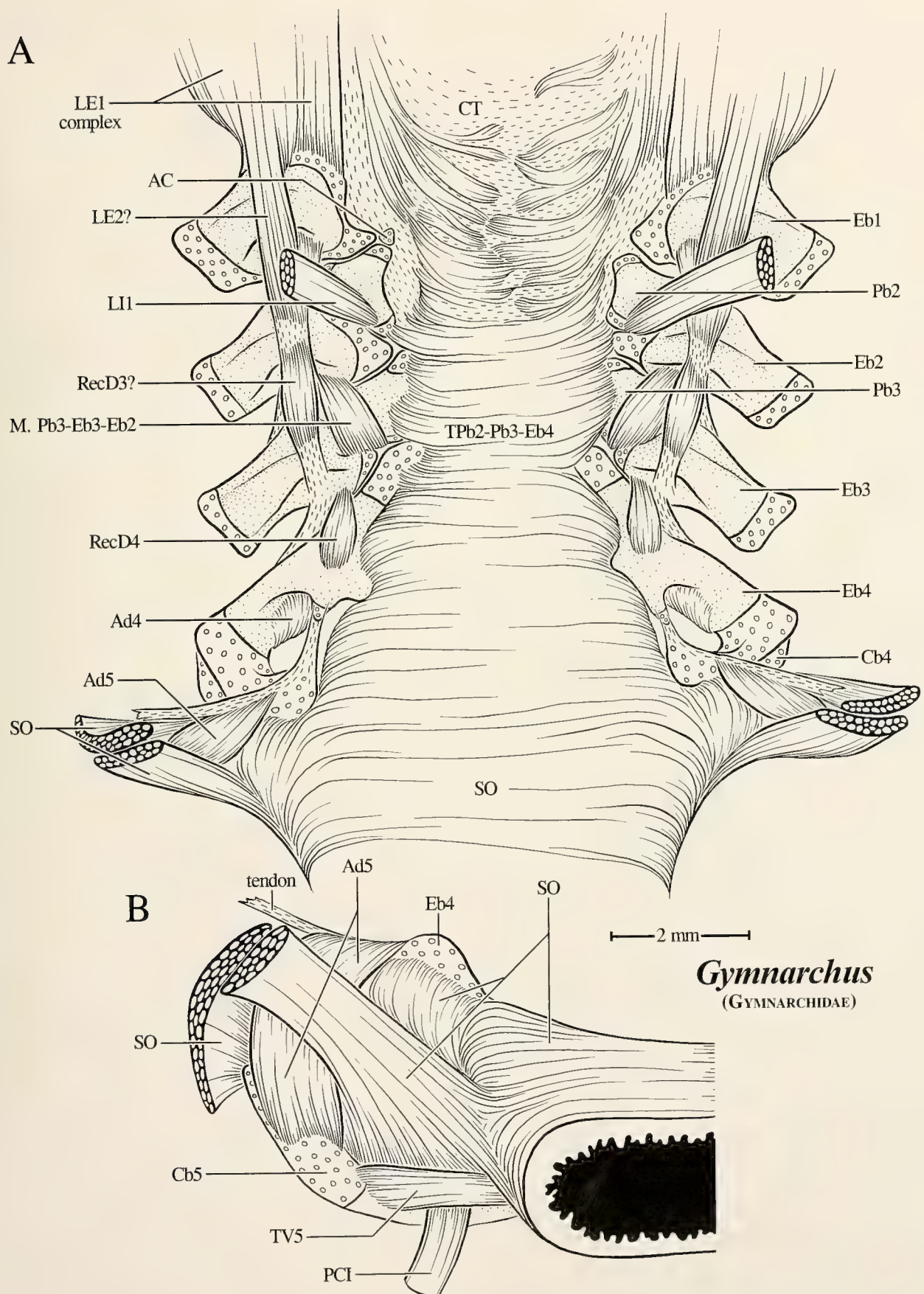
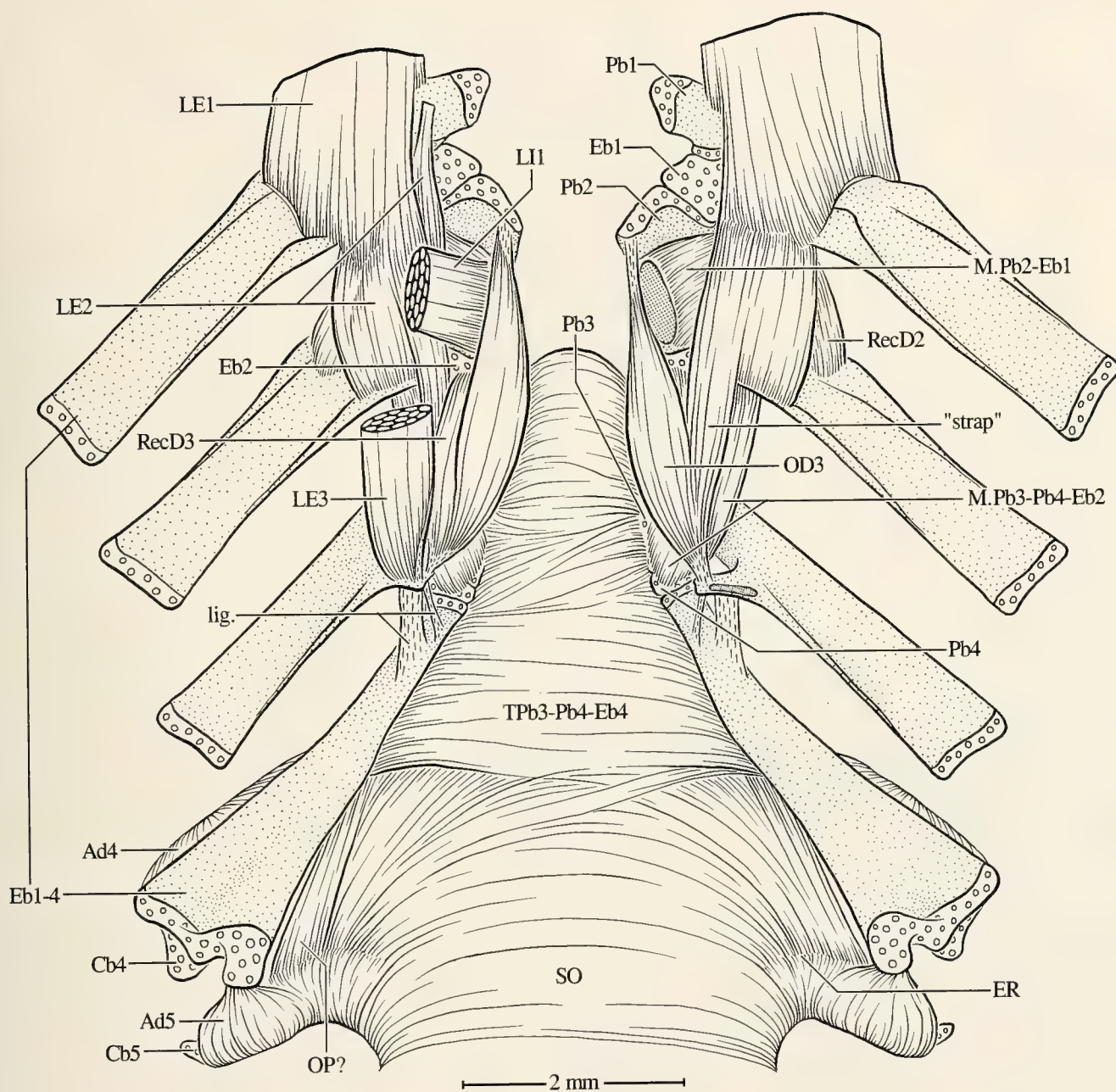


Plate 9. *Gymnarchus niloticus*, USNM 319410: A, dorsal view, LE1 complex truncated considerably anteriorly; B, posterior view, left side, Ad5 attaches to tendon and Eb4 dorsally.







***Petrocephalus***  
(Mormyridae)

Plate 10. *Petrocephalus tenuicauda*, USNM 118801: dorsal view, right-side LI1 and LE3 removed, insertions indicated by shading.



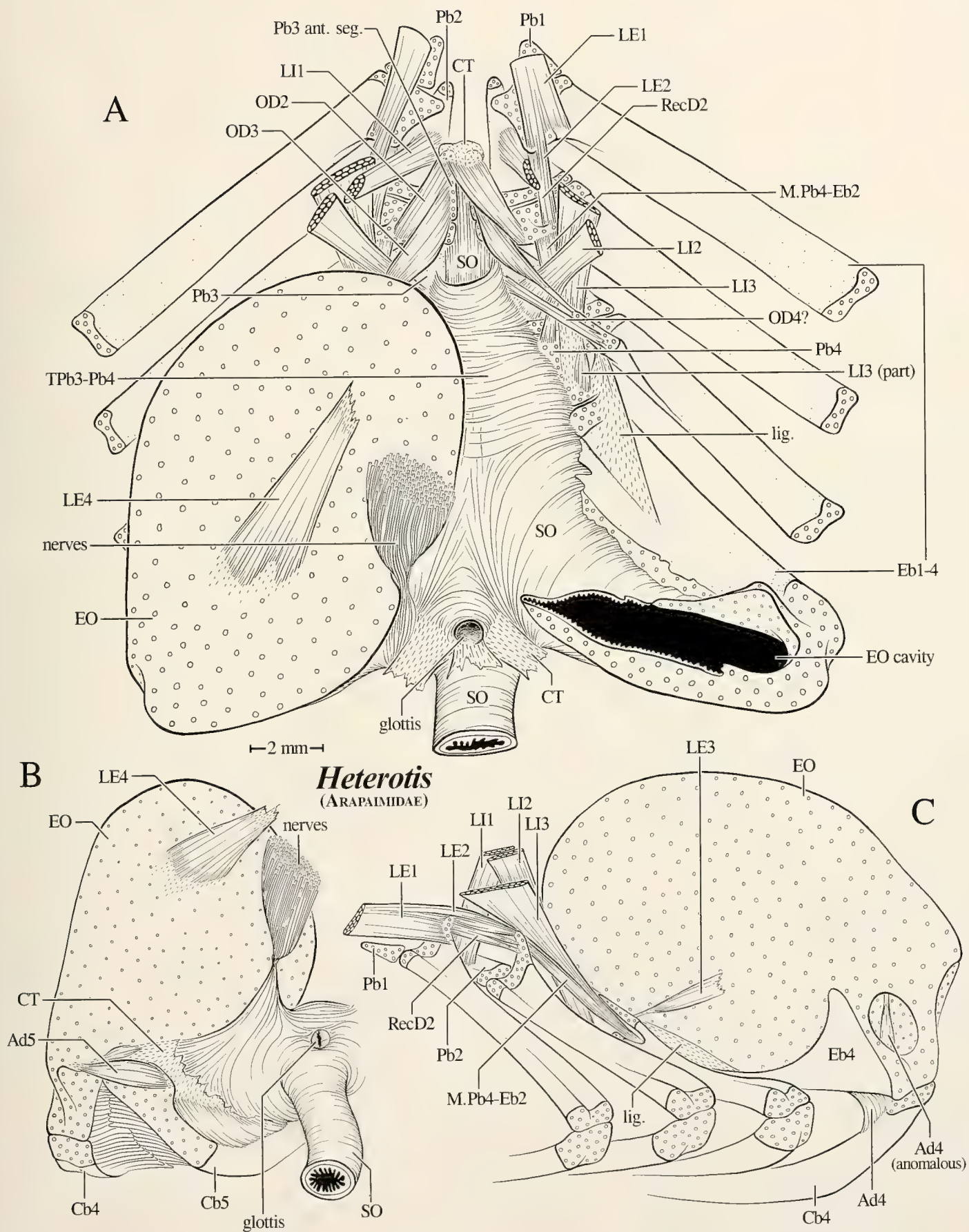


Plate 11. *Heterotis niloticus*, USNM 303214: A, dorsal view, right-side epibranchial organ removed; B, dorsal view, right side; B, posterior view, right side reversed; C, lateral view, left side.





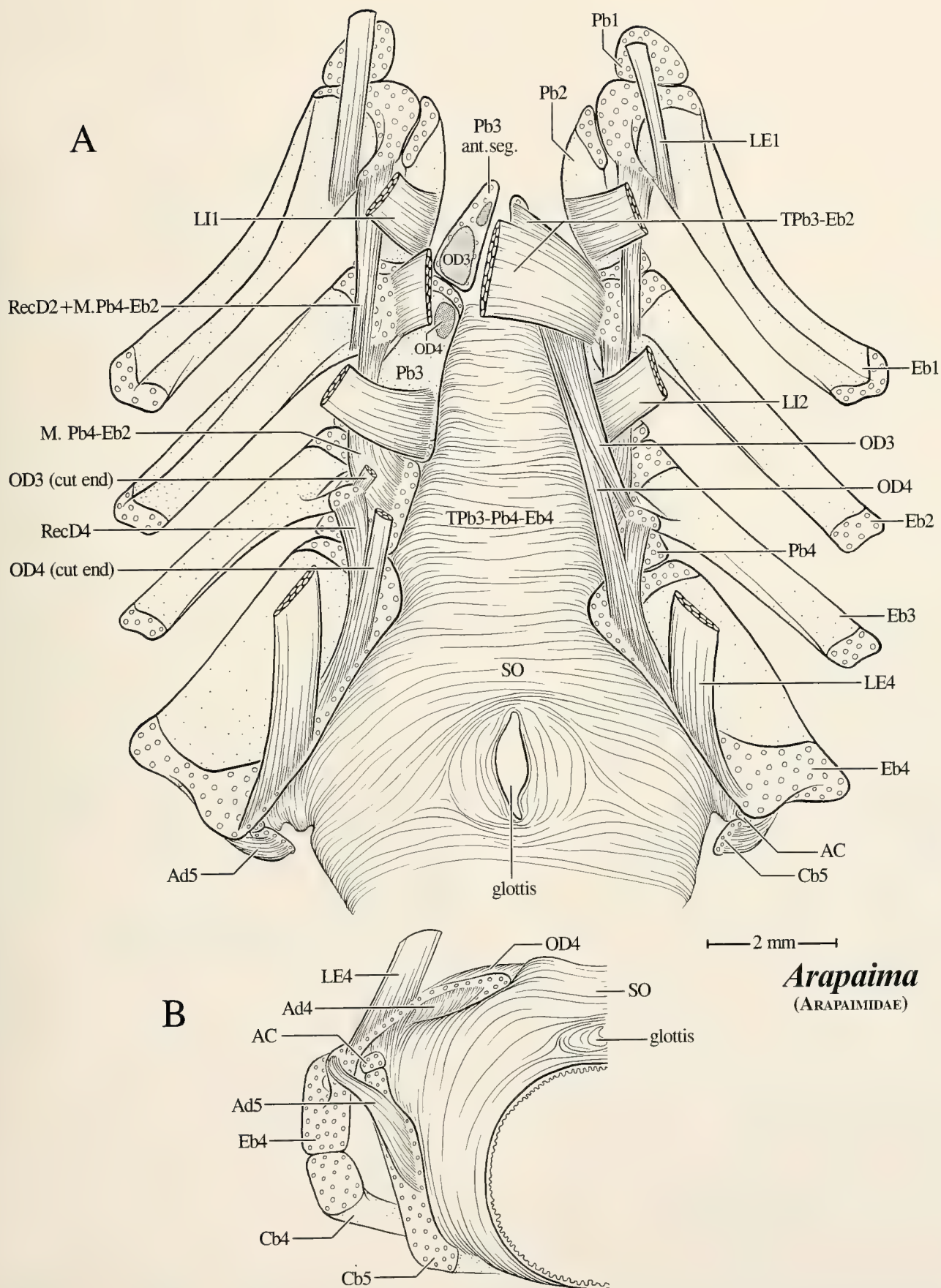


Plate 12. *Arapaima gigas*, USNM 177528: A, dorsal view, levators truncated, LE2 and LE3 absent; left-side TPb3-Eb2 cut away to expose OD3 and OD4 origins (shaded areas); left-side OD3 and OD4 cut away anteriorly to expose LI2 insertion; B, posterior view, left side; Ad4 not visible.





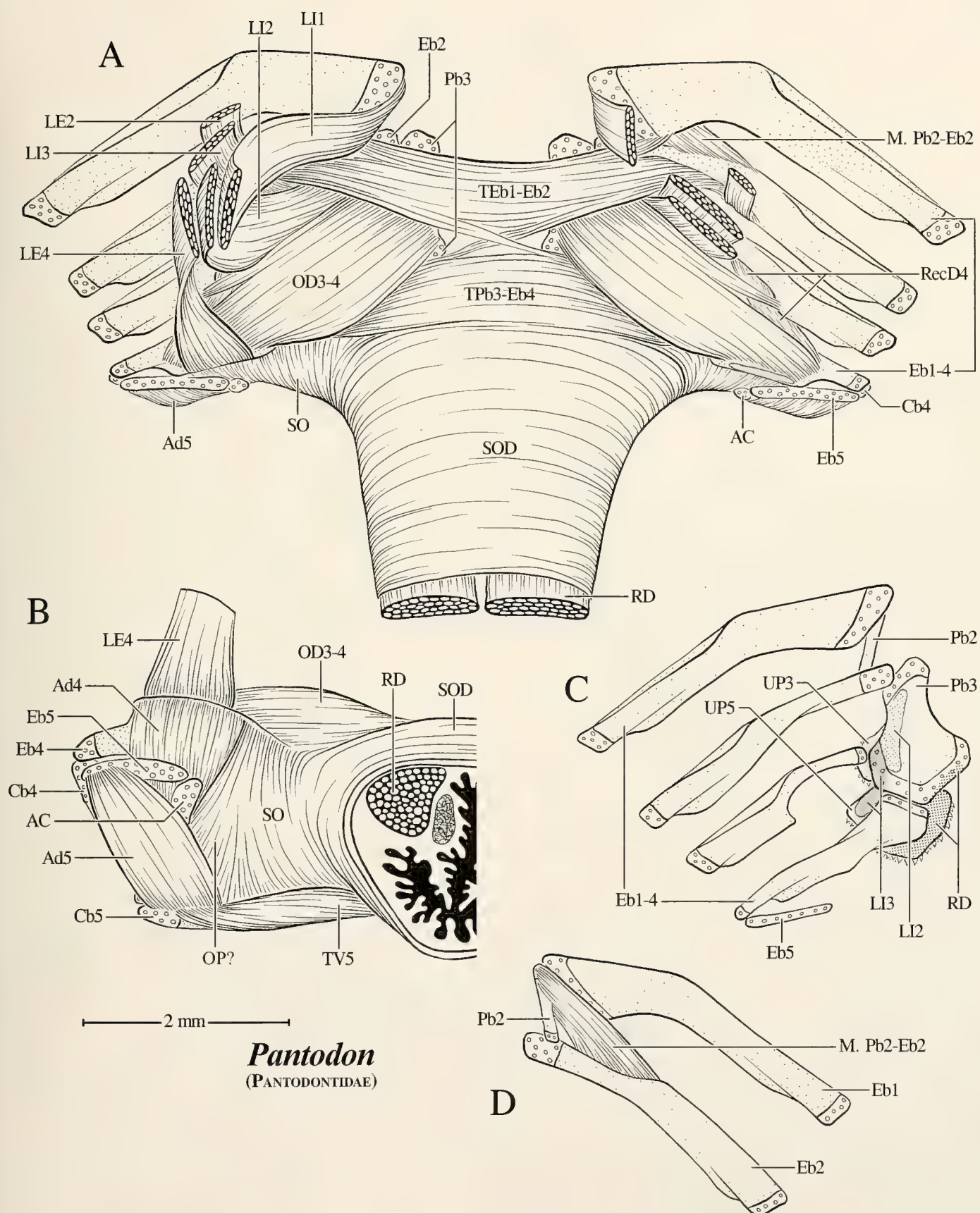
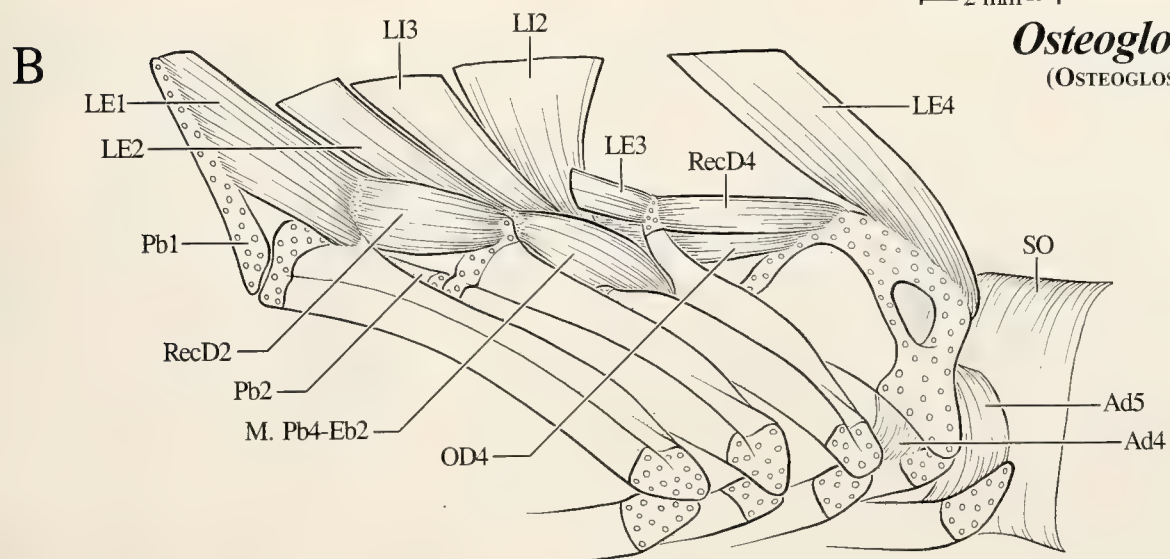
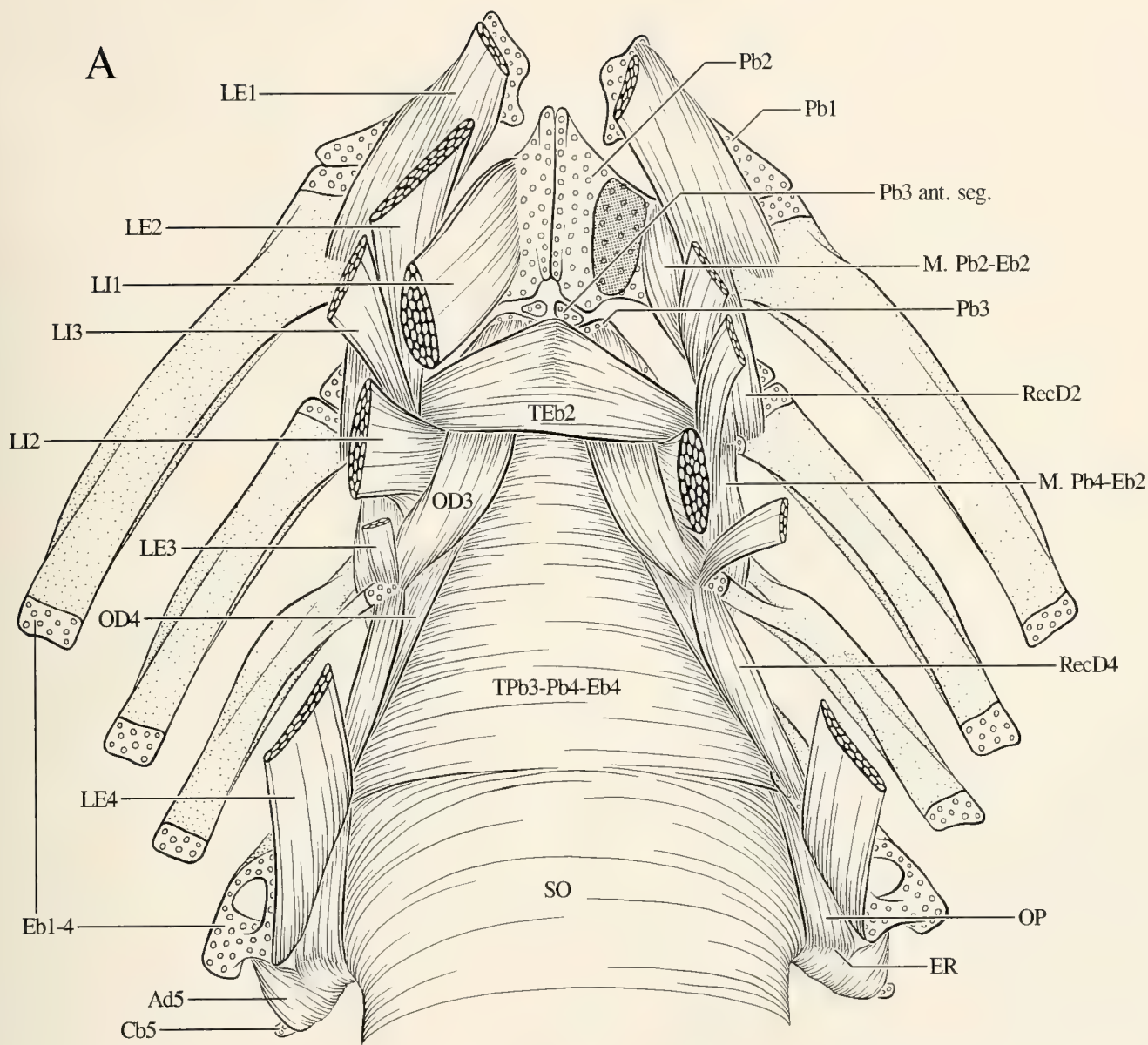


Plate 13. *Pantodon buchholzi*, USNM 353993: A, dorsal view, right-side LE4 removed; B, posterior view, left side; C, dorsal view, left-side dorsal gill-arch skeleton with insertion positions of LI2, LI3, and RD indicated; D, ventral view of right-side Eb1, Eb2, Pb2 to reveal M. Pb2-Eb2.





***Osteoglossum***  
(OSTEOGLOSSIDAE)

Plate 14. *Osteoglossum bicirrhosum*, USNM 315447: A, dorsal view, right-side LI1 removed; B, lateral view, left side, LE3 truncated considerably.





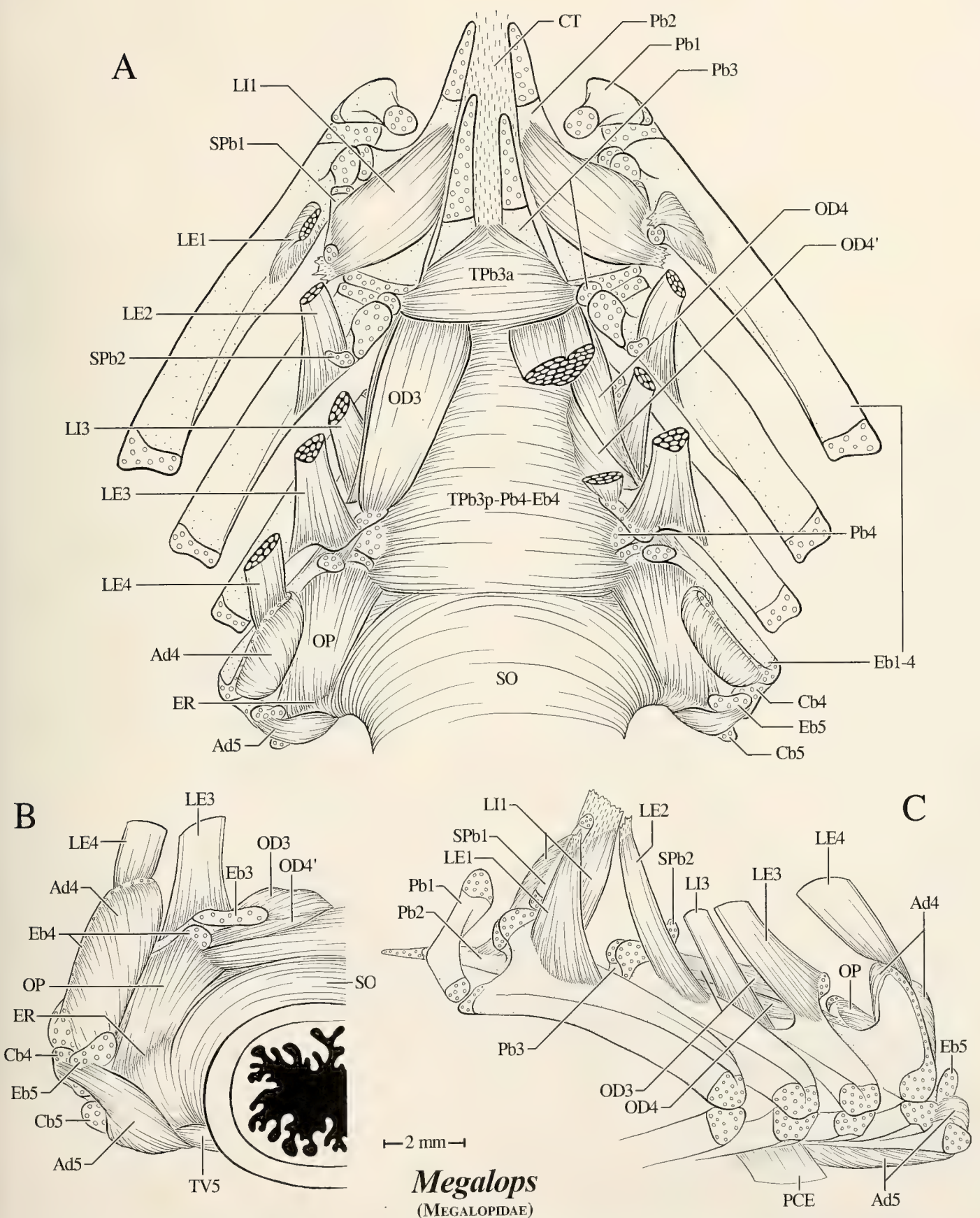


Plate 15. *Megalops cyprinoides*, USNM 350468: A, dorsal view, right-side LE4 removed and OD3 cut away; B, posterior view, left side; C, lateral view, right side reversed.





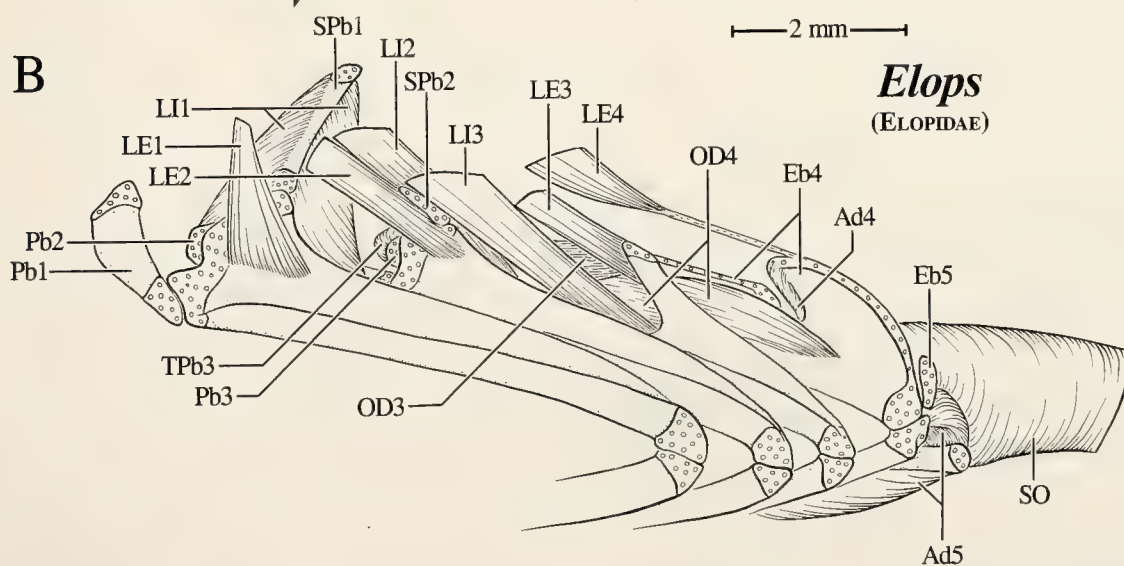
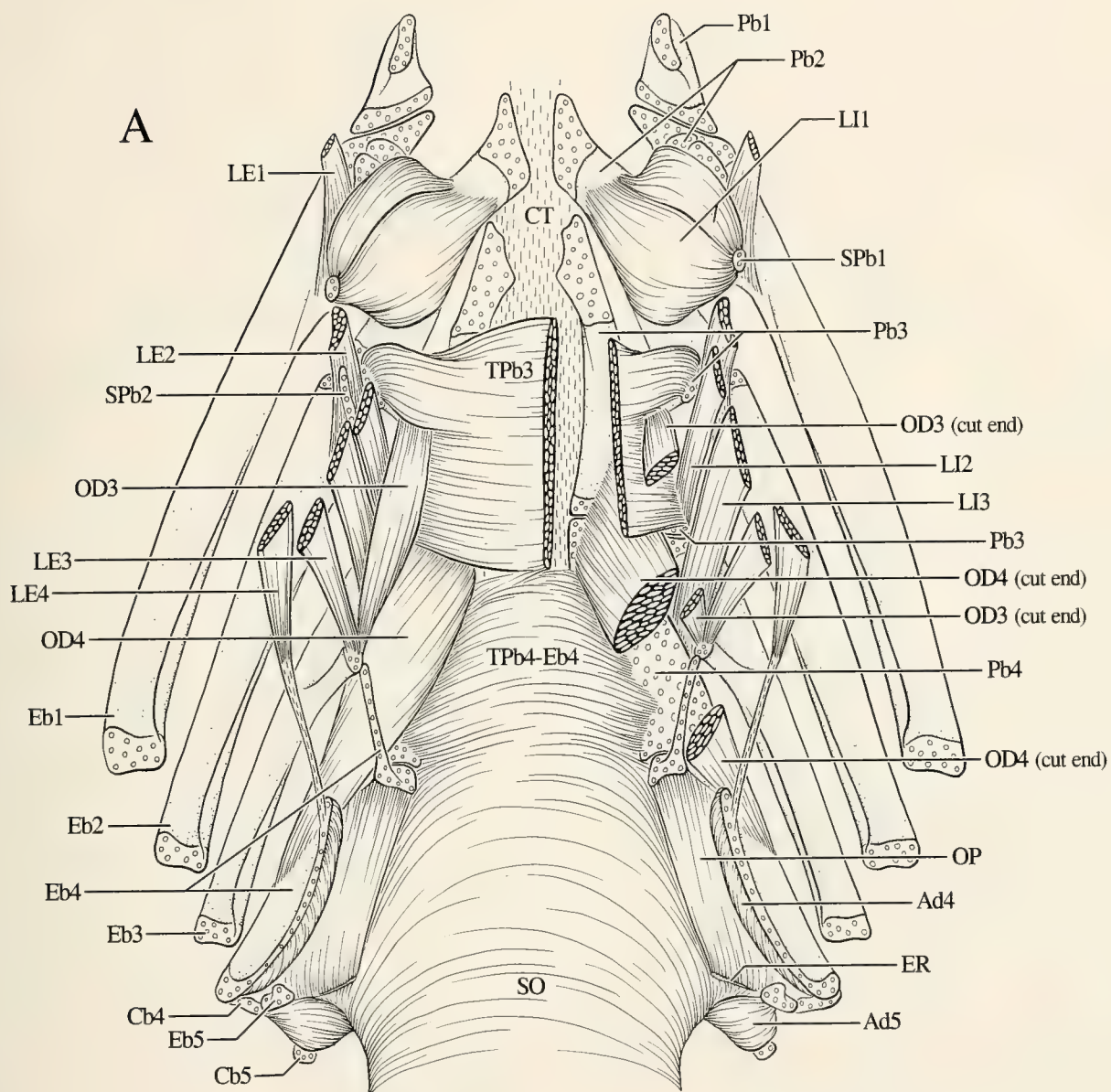


Plate 16. *Elops saurus*, USNM 121694: A, dorsal view, right-side TPb3, OD3, and OD4 cut away; B, lateral view, left side. Note: LI1 loops anteriorly from posterior attachment to SPb1, forming two sheet-like layers with less extensive posterior layer incompletely overlapping surface of more extensive anterior layer; LI2 on Pb3 ventrally and SPb2 posteriorly; LI3 on Pb4 ventrally with few anterior fibers on SPb2.



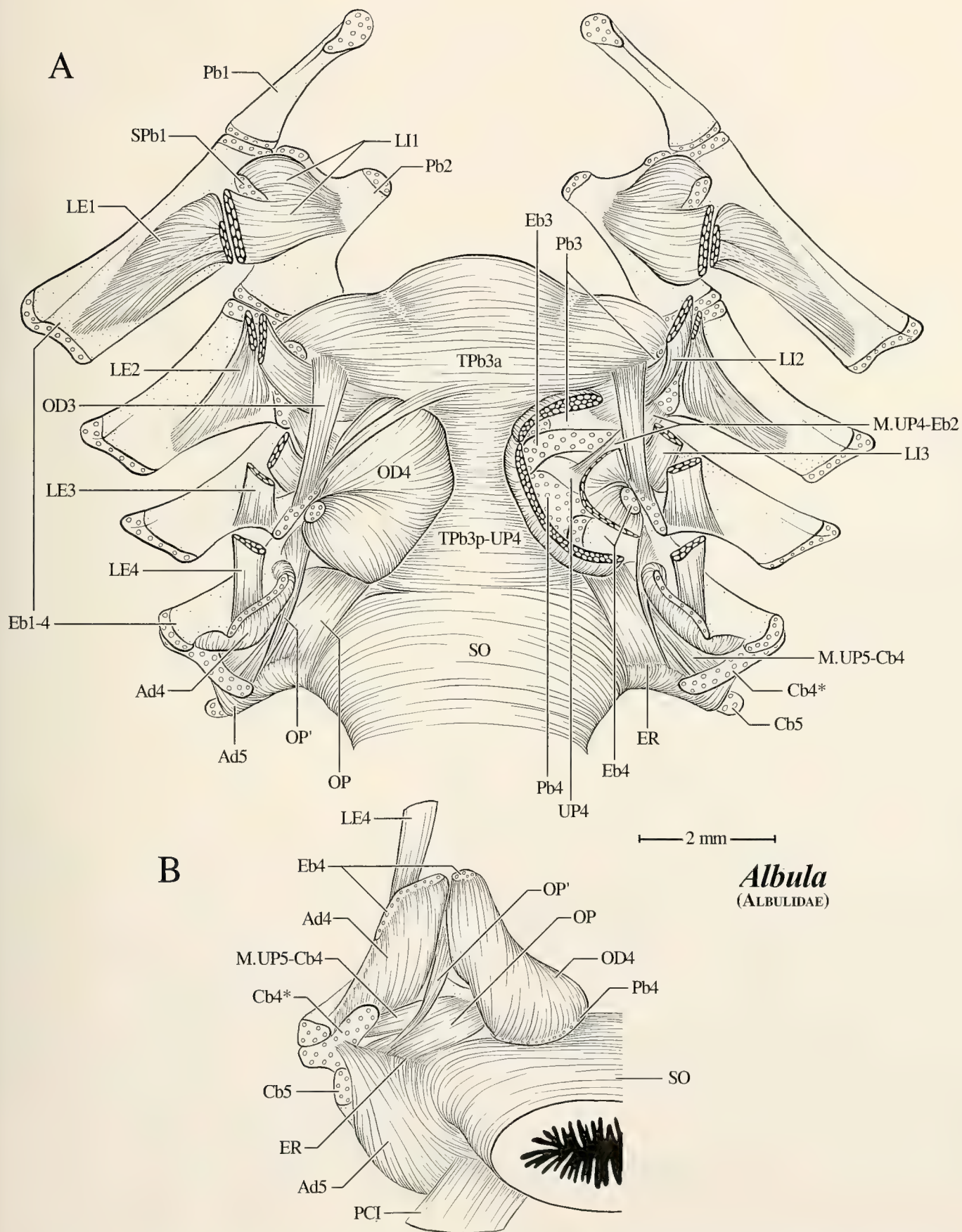


Plate 17. *Albula vulpes*?, USNM 247511: A, dorsal view, right-side OD4 cut away; note anomalous slip of muscle inserting on dorsomedial process of Eb4 passes through right side of TPb3 and arises from hidden origin of right-side OD3; OD4 inserts dorsally only on dorsomedial process of Eb4; B, posterior view, left side.





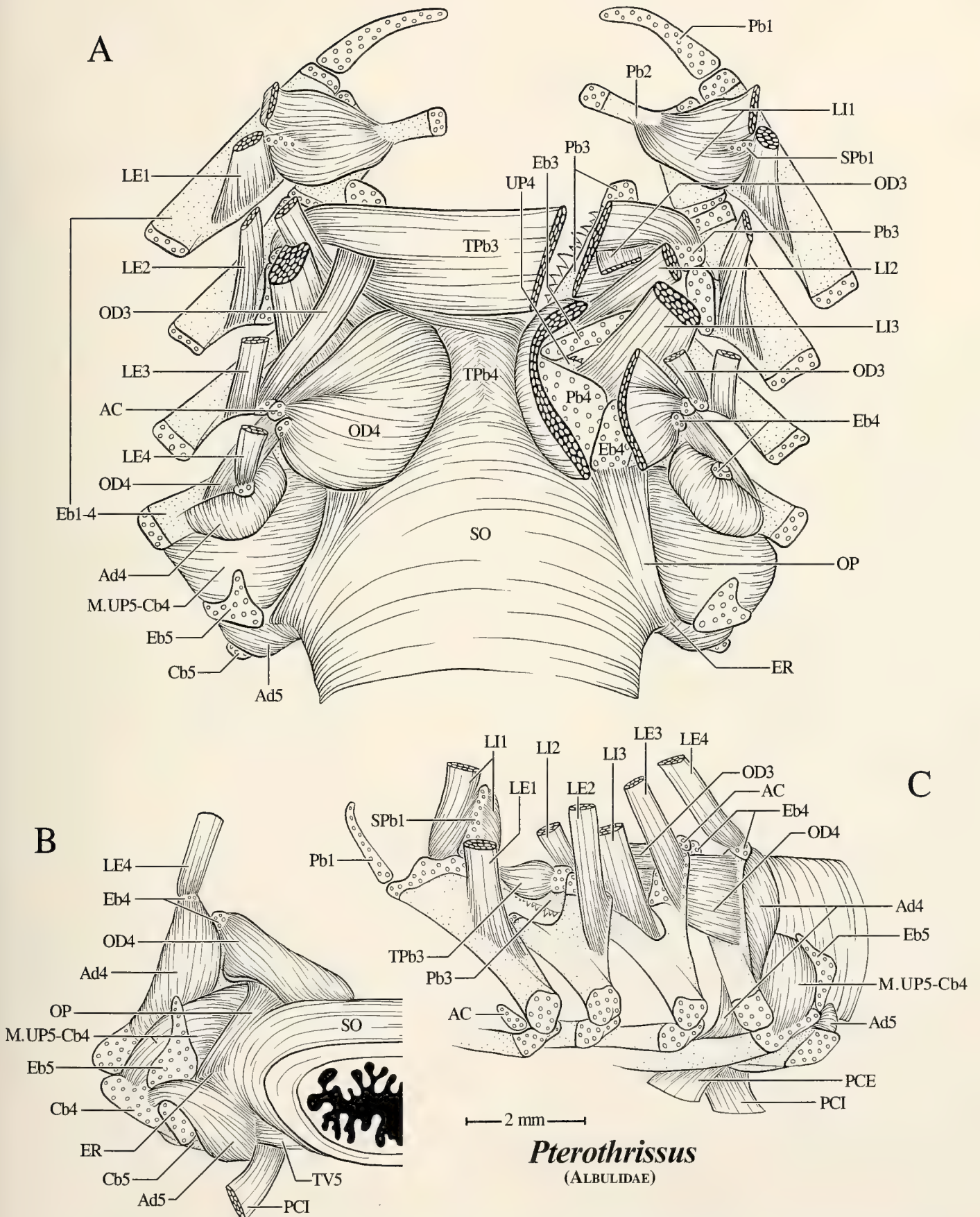


Plate 18. *Pterothrissus gissu*, FRSKU 22120: A, dorsal view, right-side LE4 removed and TPb3, OD3, OD4 cut away to reveal insertions of LI2 and LI3; B, posterior view, left side; C, lateral view, right side reversed.





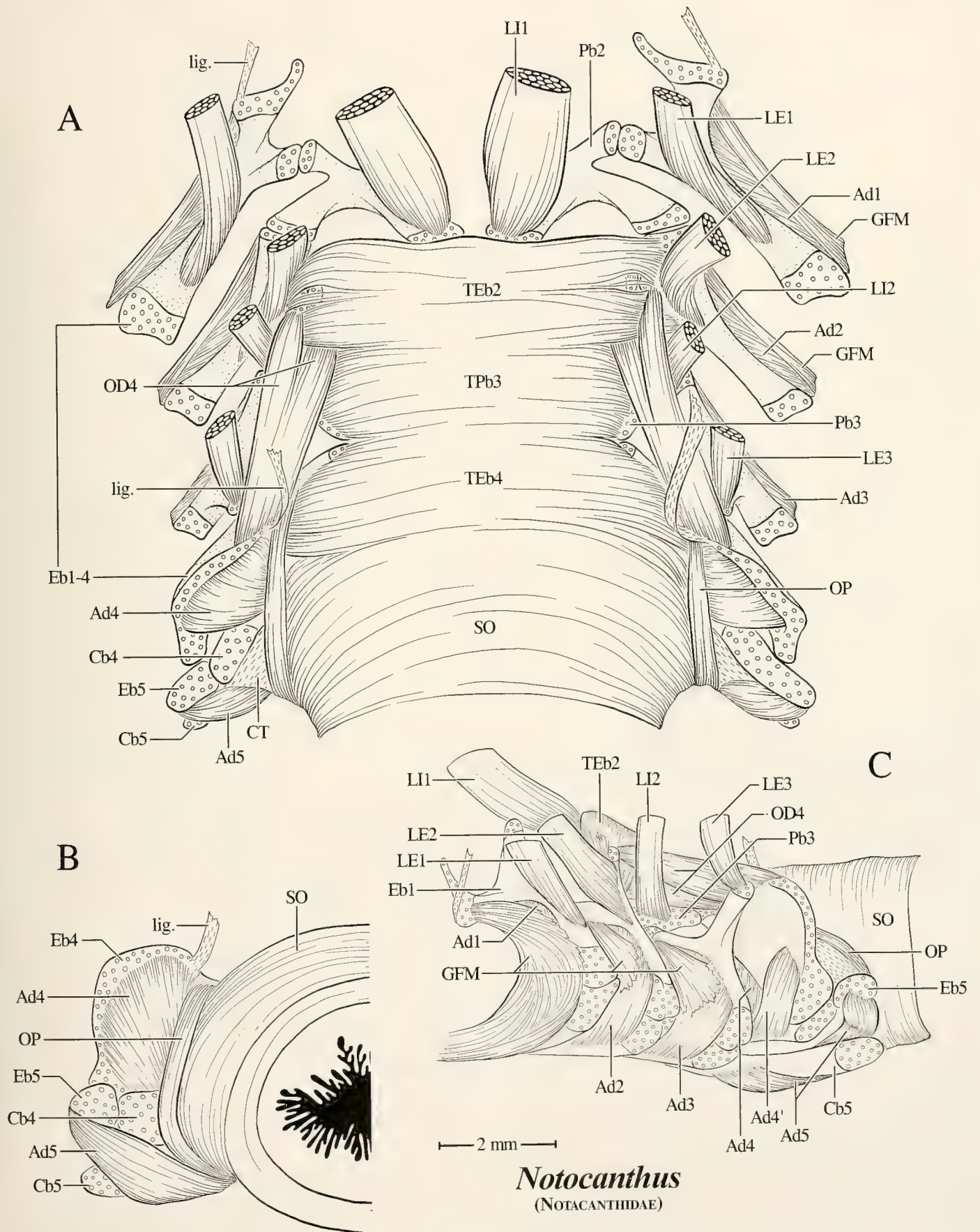
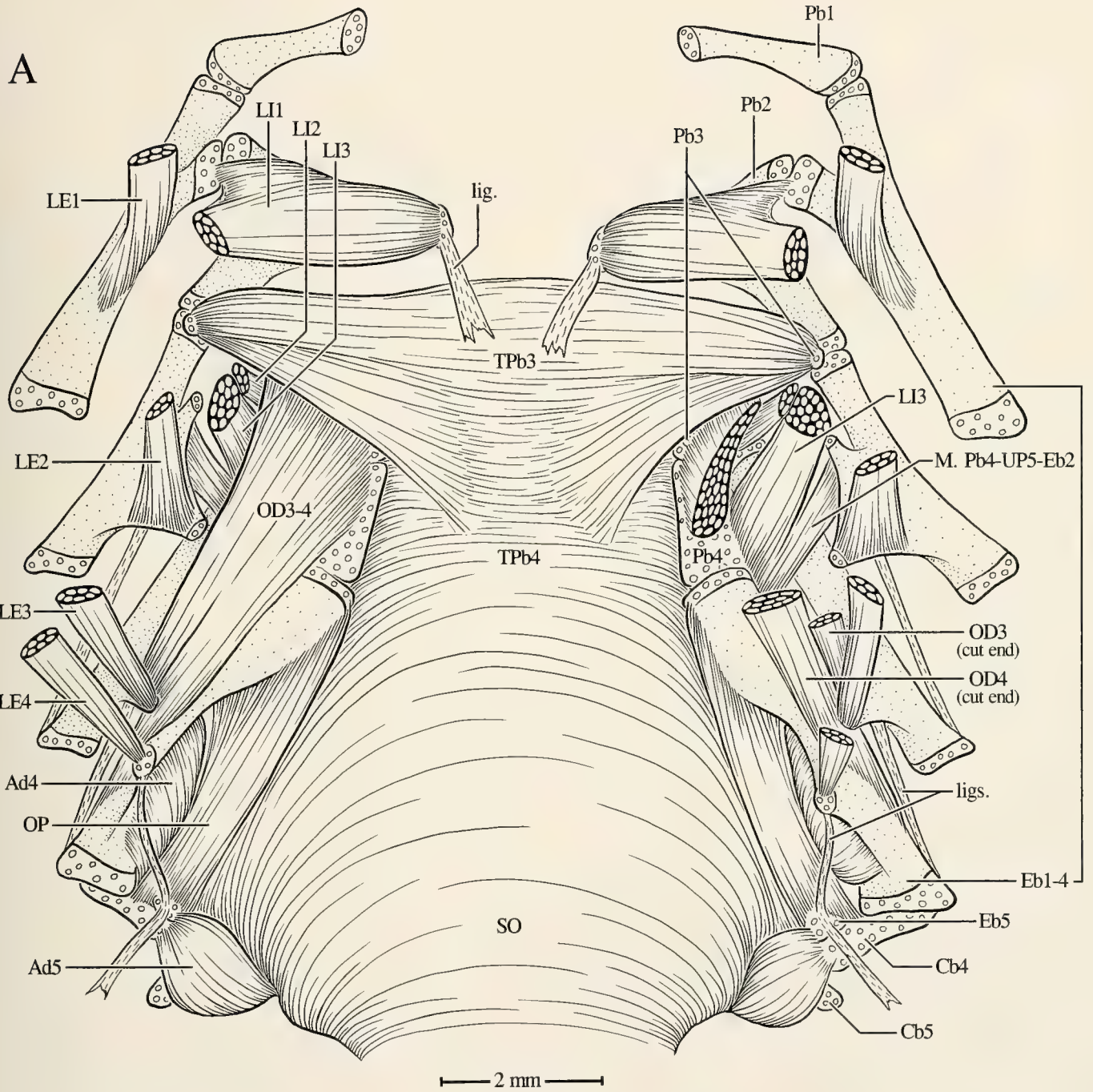


Plate 19. *Notocanthus chemnitzii*, USNM 214342: A, dorsal view, right-side LE3 added (specimen anomalously lacked muscle); B, posterior view, left side; C, lateral view, left side; note GFM overlaps Ad1 dorsolaterally, continuous with Ad1 ventromedially; GFMs on second and third arches damaged, complete extent undetermined.





***Aldrovandia***  
(HALOSAURIDAE)

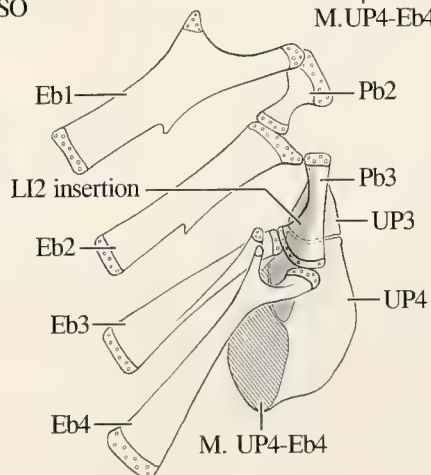
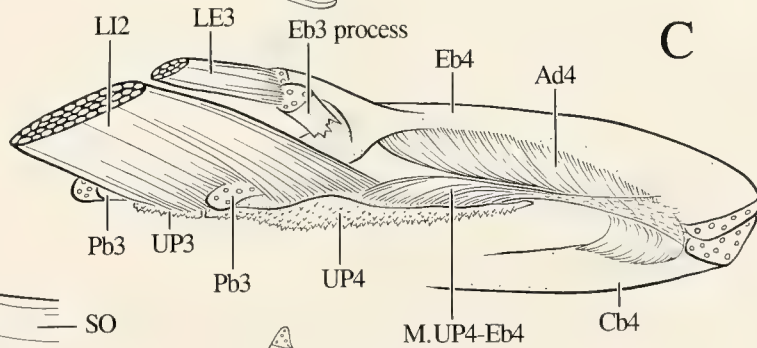
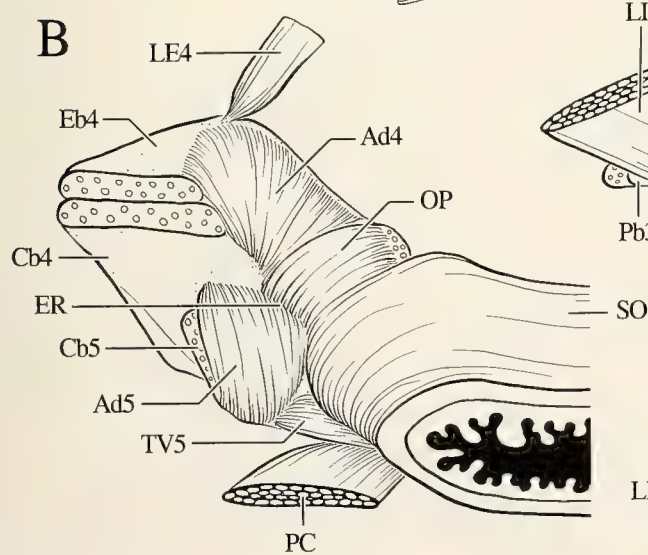
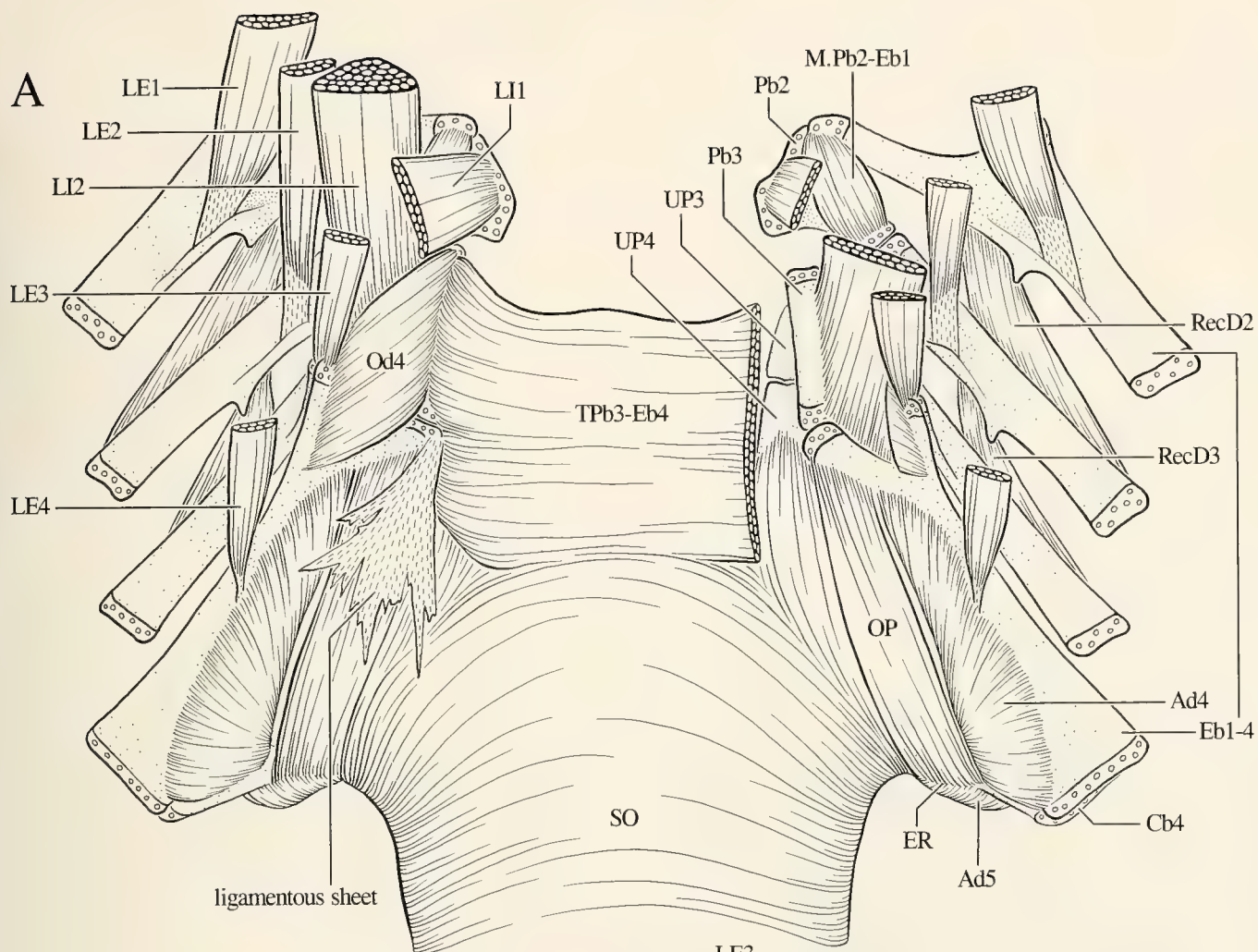
Plate 20. *Aldrovandia affinis*, USNM 319707: dorsal view, right-side OD3-4 cut away.



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Plate 21. *Conger cinereus*, A–C, USNM 115969 (toothplates labeled according to Nelson, 1966): A, dorsal view, right-side TPb3-Eb4 and OD4 cut away; fascia-like ligament originating on medial tip of Eb4 is shown (in part) only on the left side; B, posterior view, left side; C, lateral view, fourth arch (Eb3 uncinatate process included), right side reversed; D, *C. triponiceps*, ANSP 106182, cleared and stained: dorsal view, left-side dorsal gill arches, gray area indicates extent of LI2 insertion on Pb3, UP3, and UP4 based on *C. cinereus*.



— 2 mm —

***Conger***  
(CONGRIDAE)





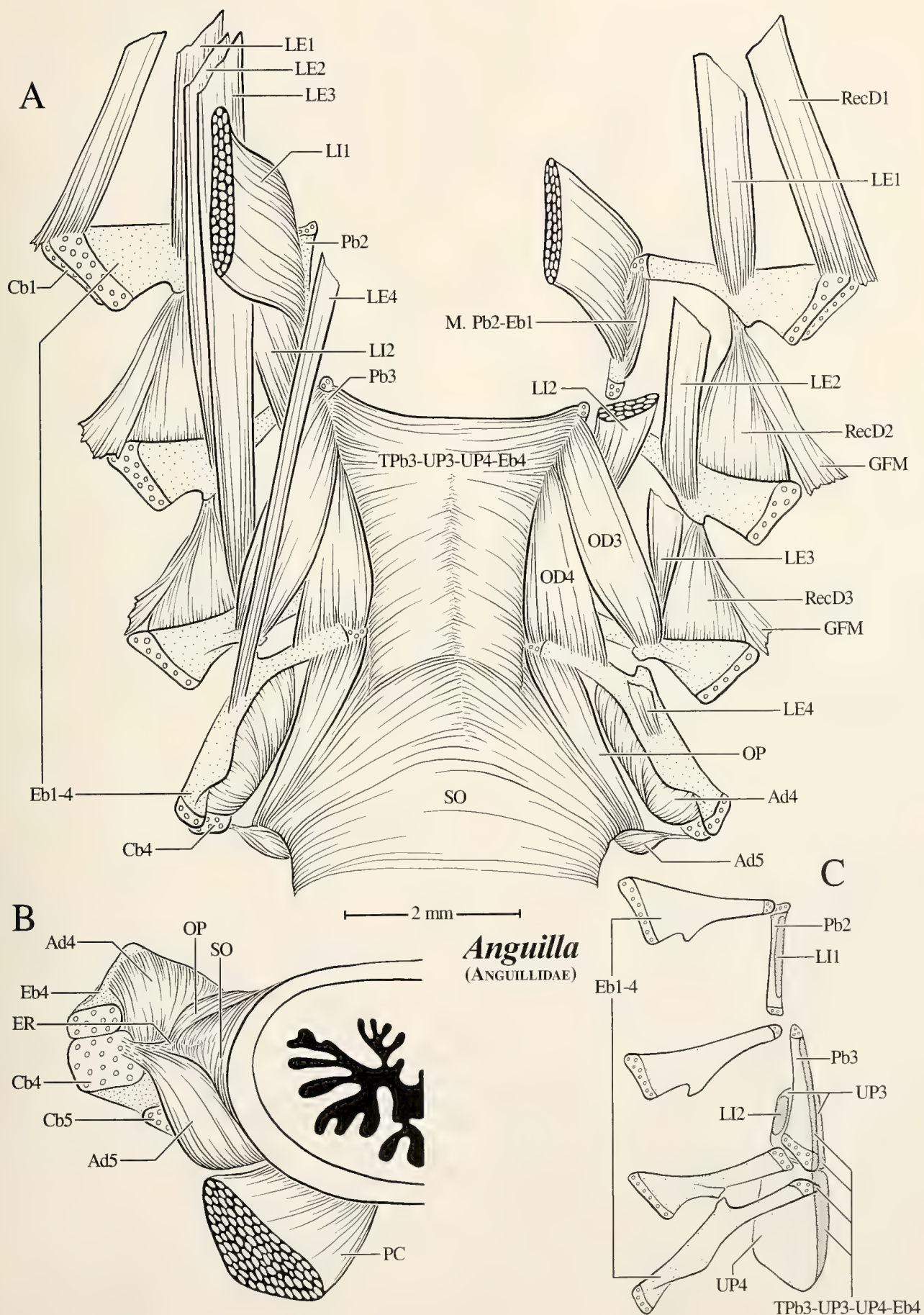
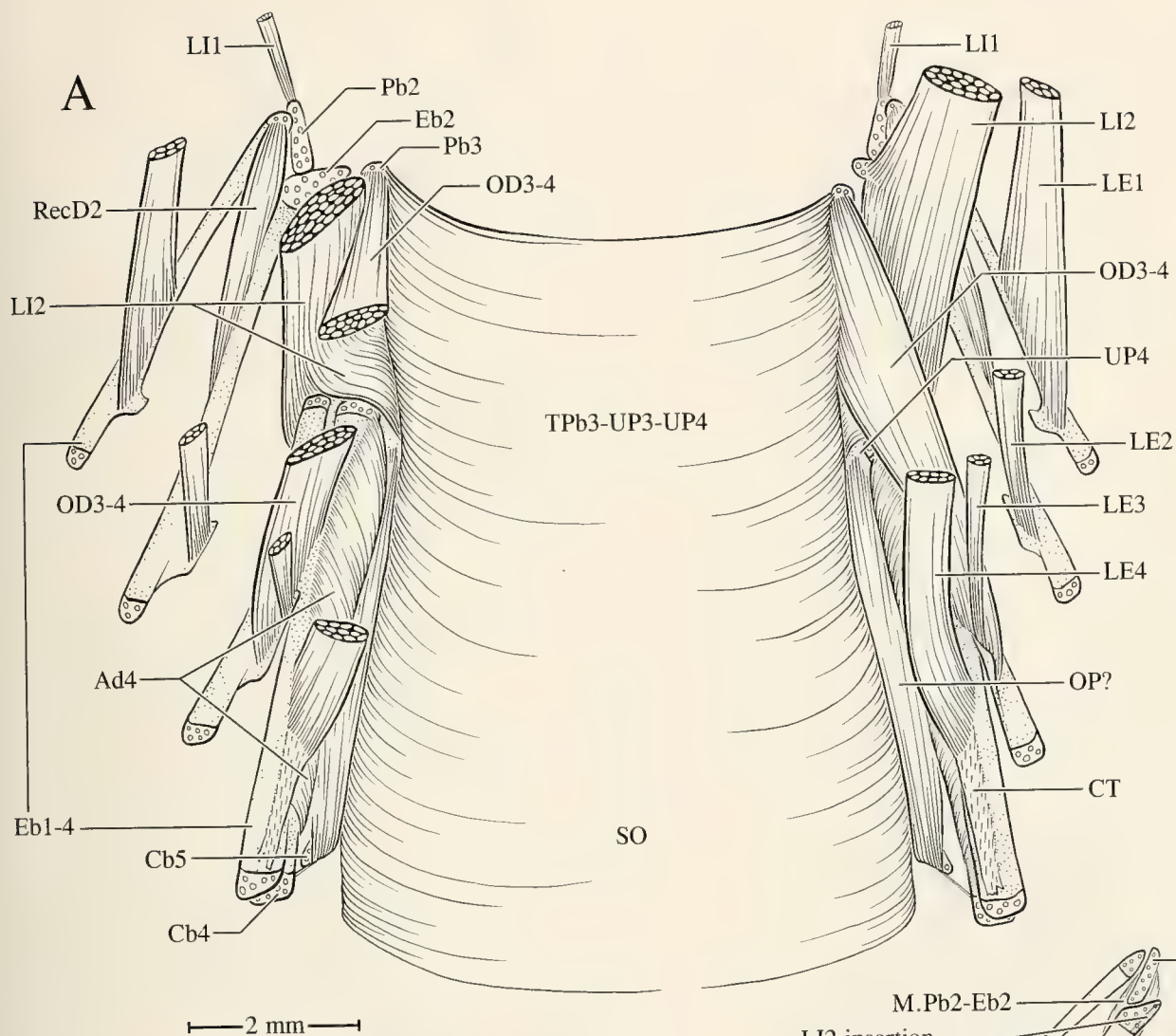


Plate 22. *Anguilla rostrata*, USNM 340815: A, dorsal view, right-side LI1 forced medially to reveal M. Pb2-Eb1; B, posterior view; C, left-side dorsal gill arches with insertions of LI1, LI2, and TPb3-Eb4-UP4-UP5 indicated by darker shaded areas.





***Synaphobranchus***  
(SYNAPHOBANCHIDAE)

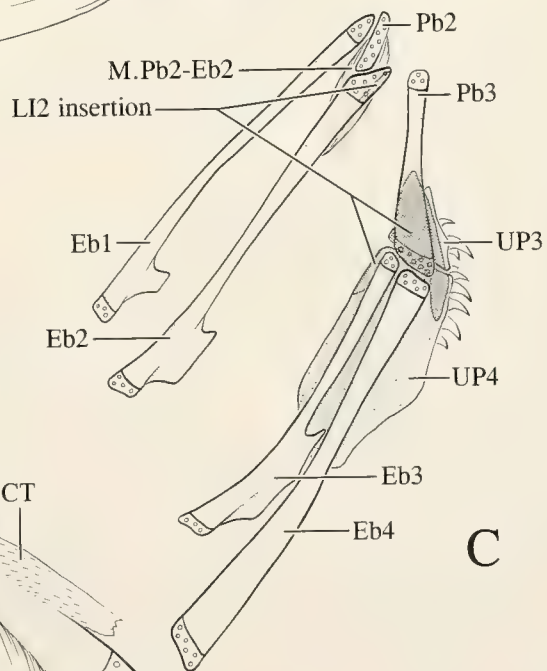
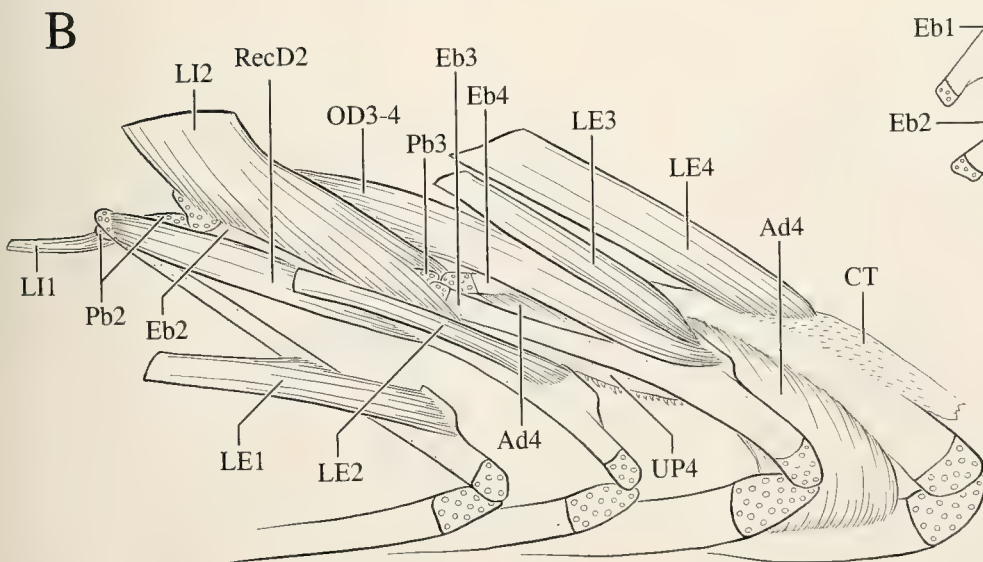
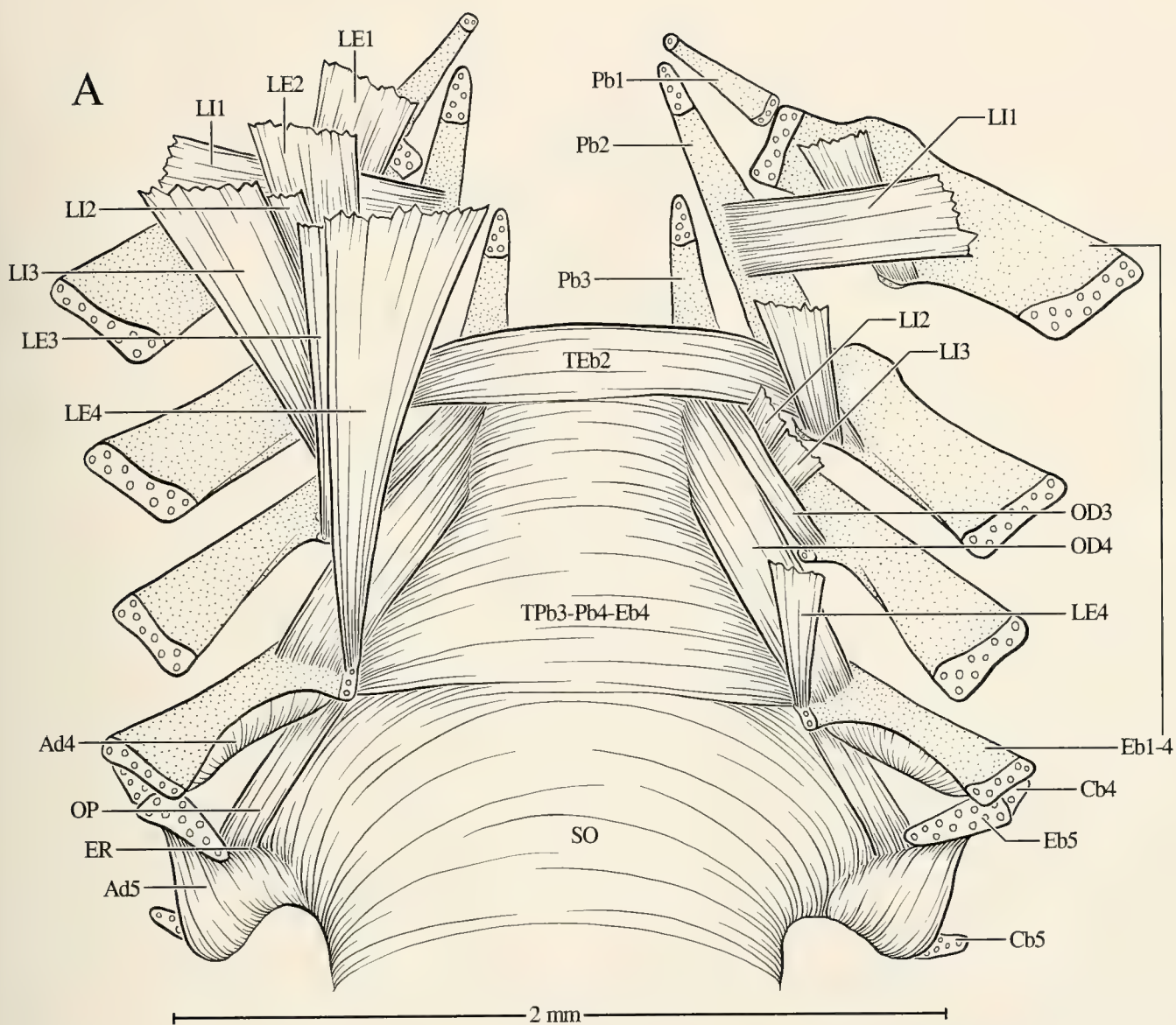


Plate 23. A,B, *Synaphobranchus* sp., USNM 316662: A, dorsal view, left-side OD3-4 cut away; B, lateral view, right side reversed (SO not shown); C, *S. kaupi*, VIMS uncataloged, cleared and stained: dorsal view, left-side dorsal gill arches, M. Pb2-Eb2 indicated, insertion of LI2 indicated by darker shaded areas.







***Denticeps***  
(DENTICIPITIDAE)

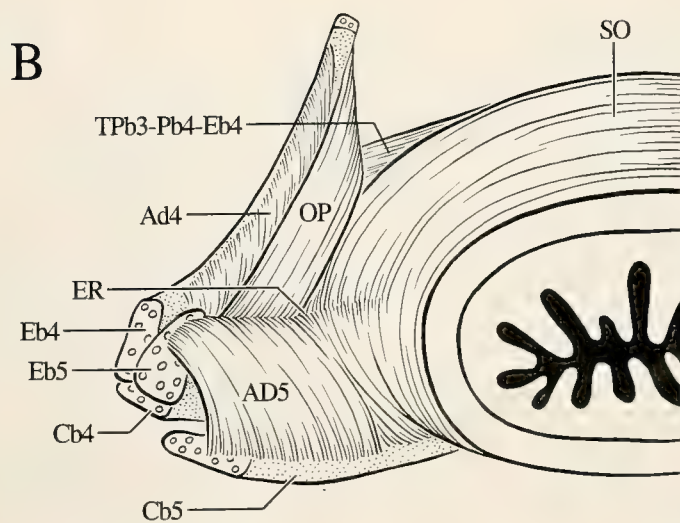


Plate 24. *Denticeps clupeioides*, USNM 358795: A, dorsal view, right-side LE3 removed; B, posterior view, right side reversed.





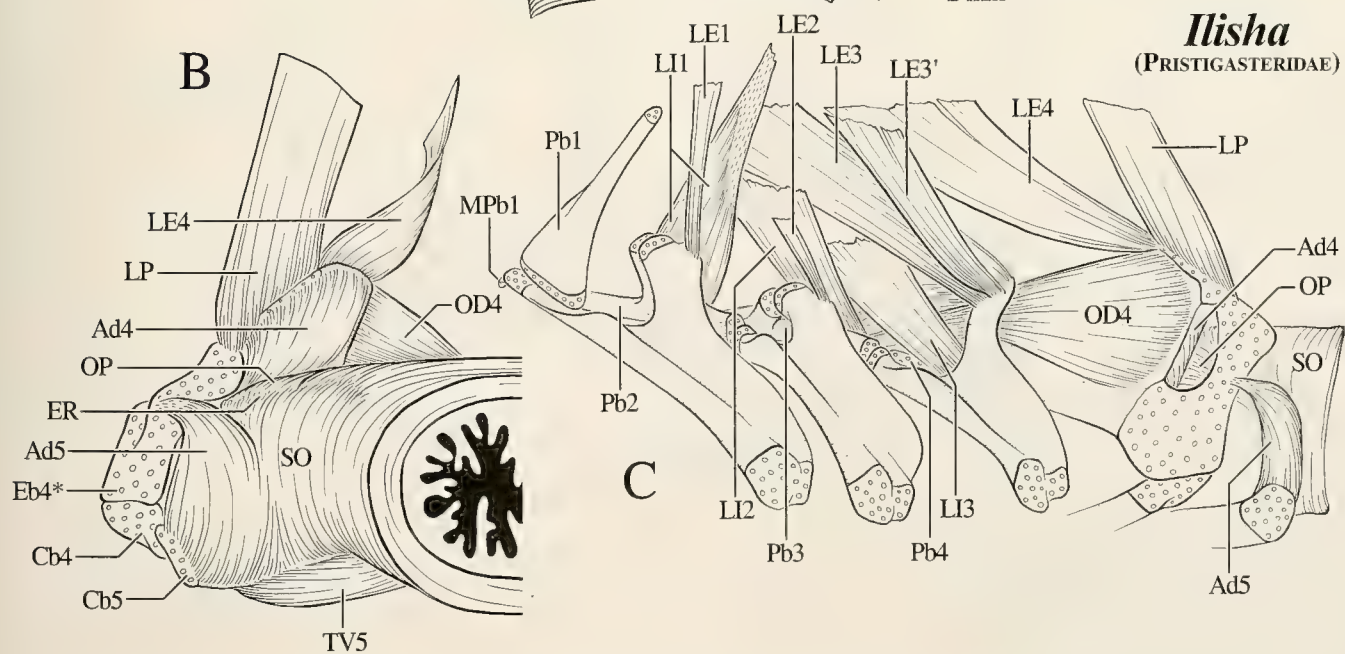
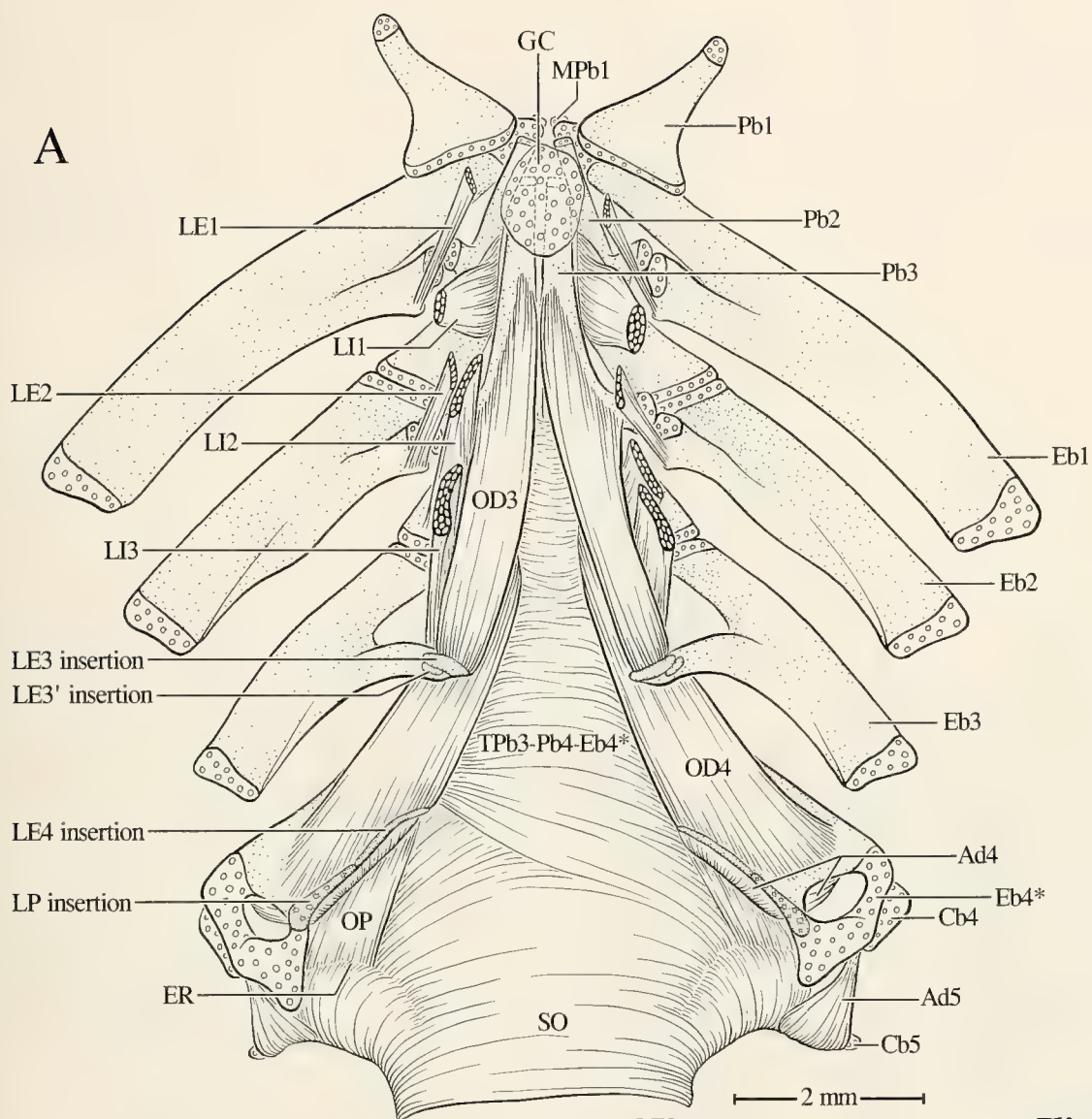
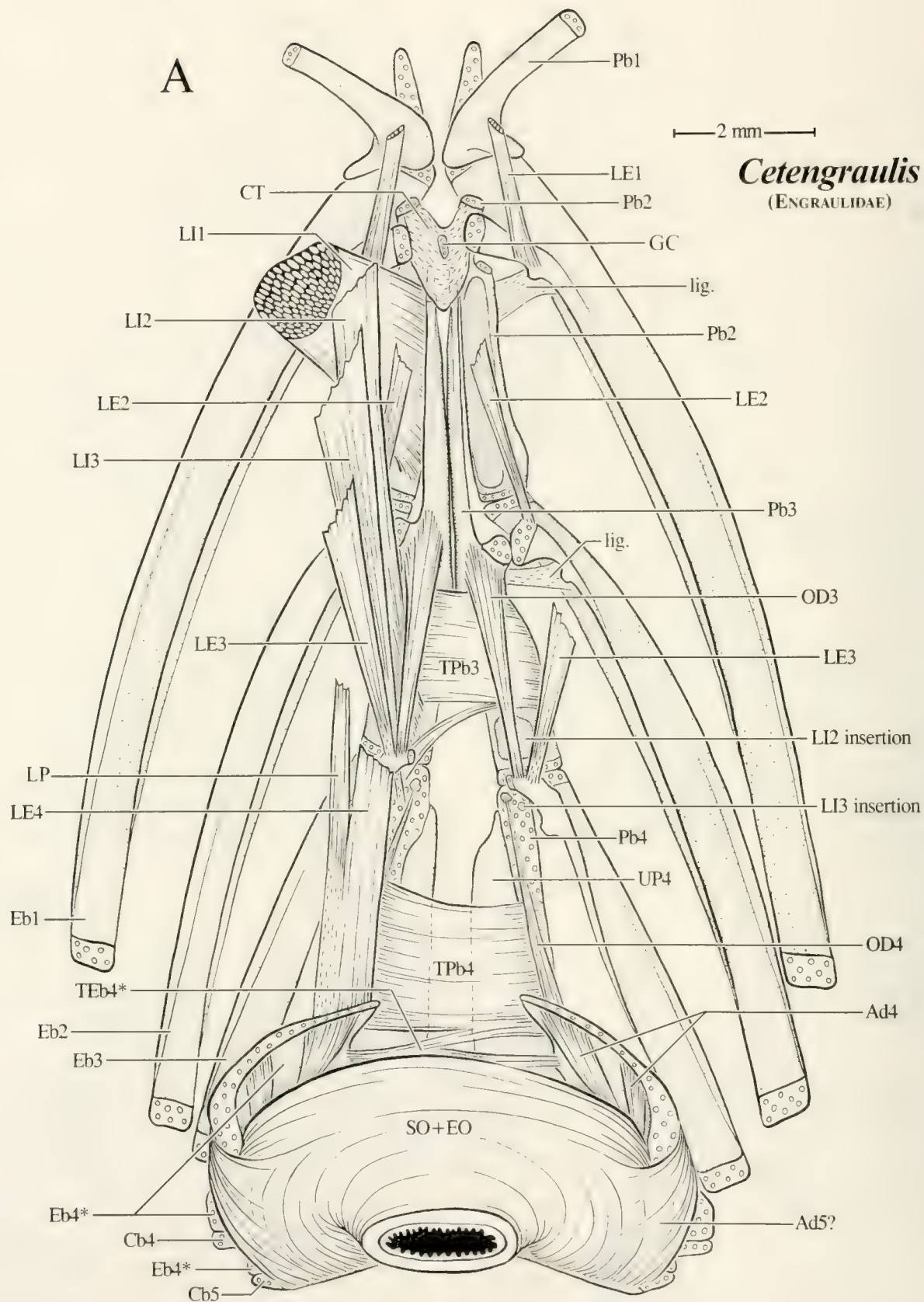
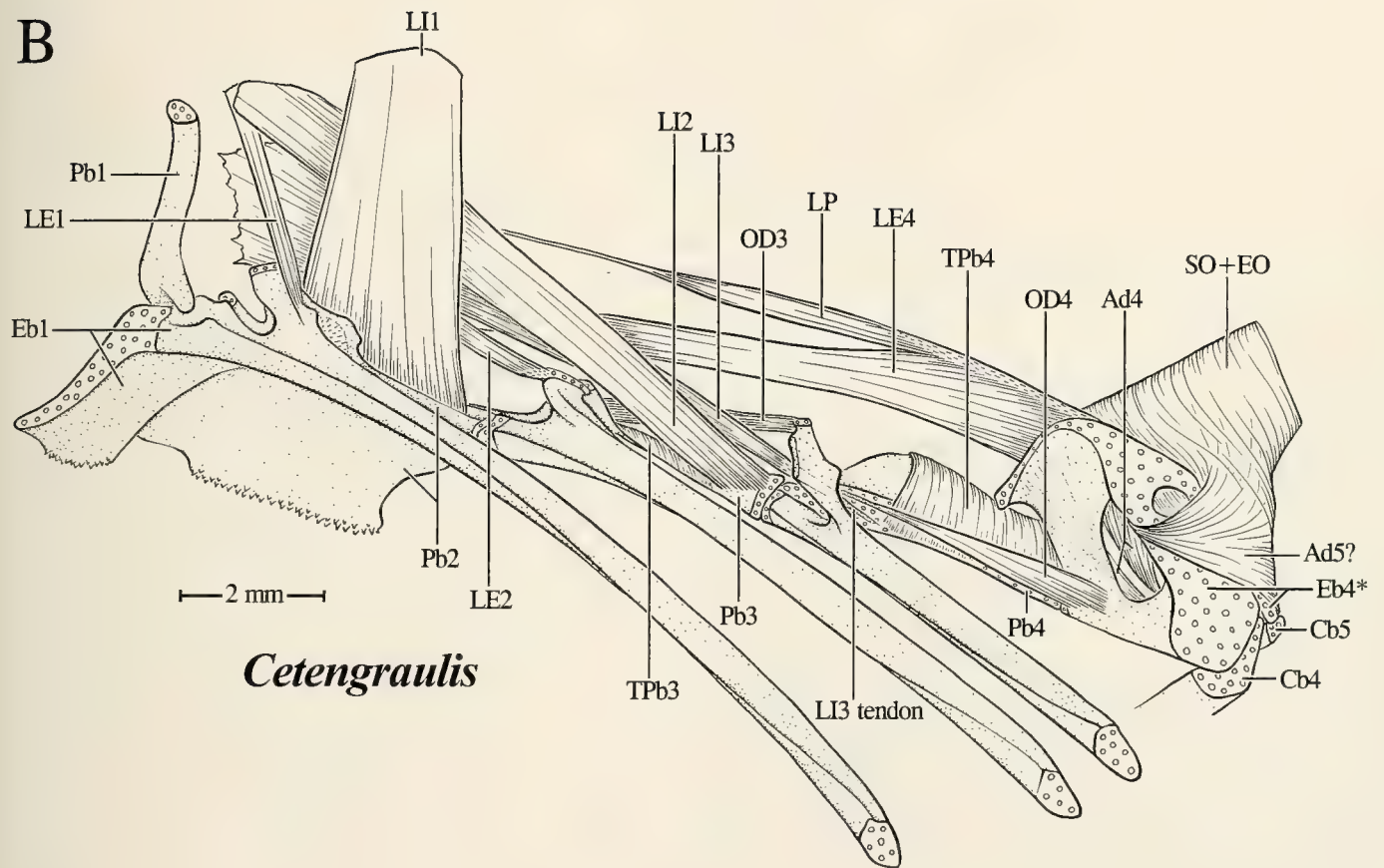


Plate 25. *Ilisha africana*, USNM 357405: A, dorsal view, Pb1s rotated anteriorly, LE3, LE3', LE4, and LP removed from both sides, insertions indicated by darker shaded areas on Eb4; B, posterior view, left side; C, lateral view, left side.



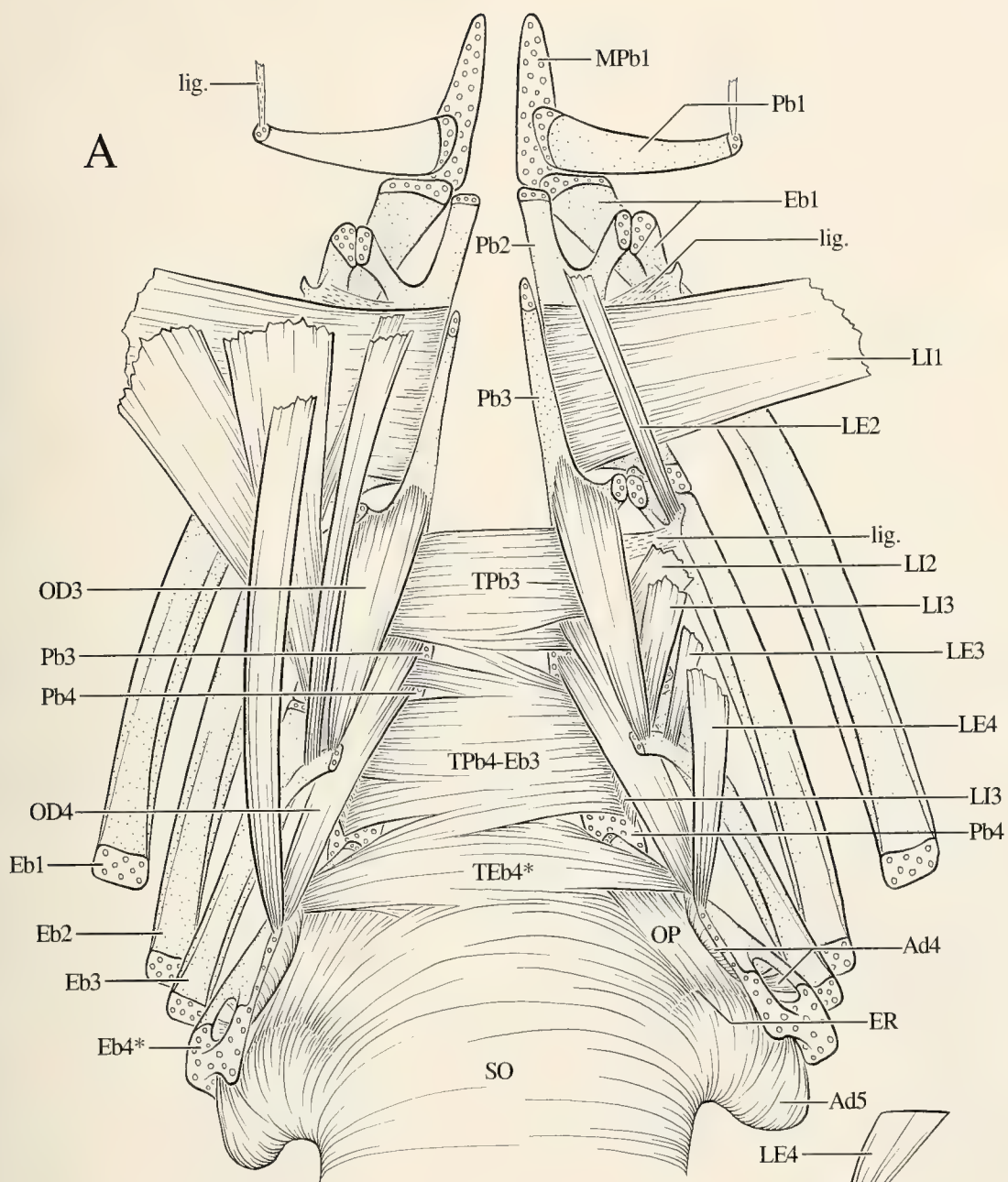
Plates 26.1, 26.2. *Cetengraulis edentulus*, USNM 186377: A, dorsal view, right-side LIs removed (insertions indicated), right-side LE4 and LE4' removed; B, lateral view, left side, LE3 removed (insertion area shown as darkly shaded area on Eb3 uncinat process).

B



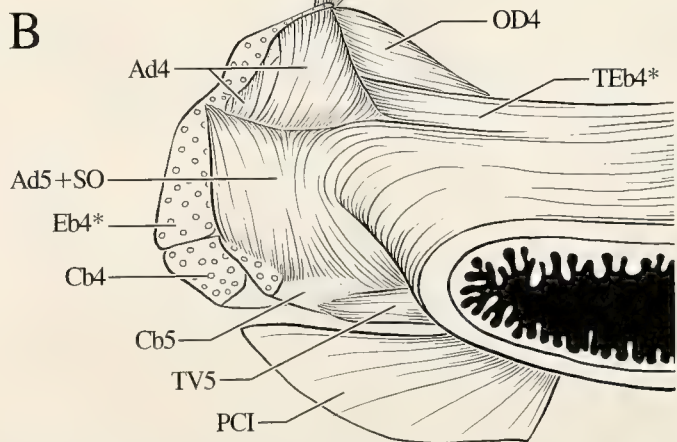


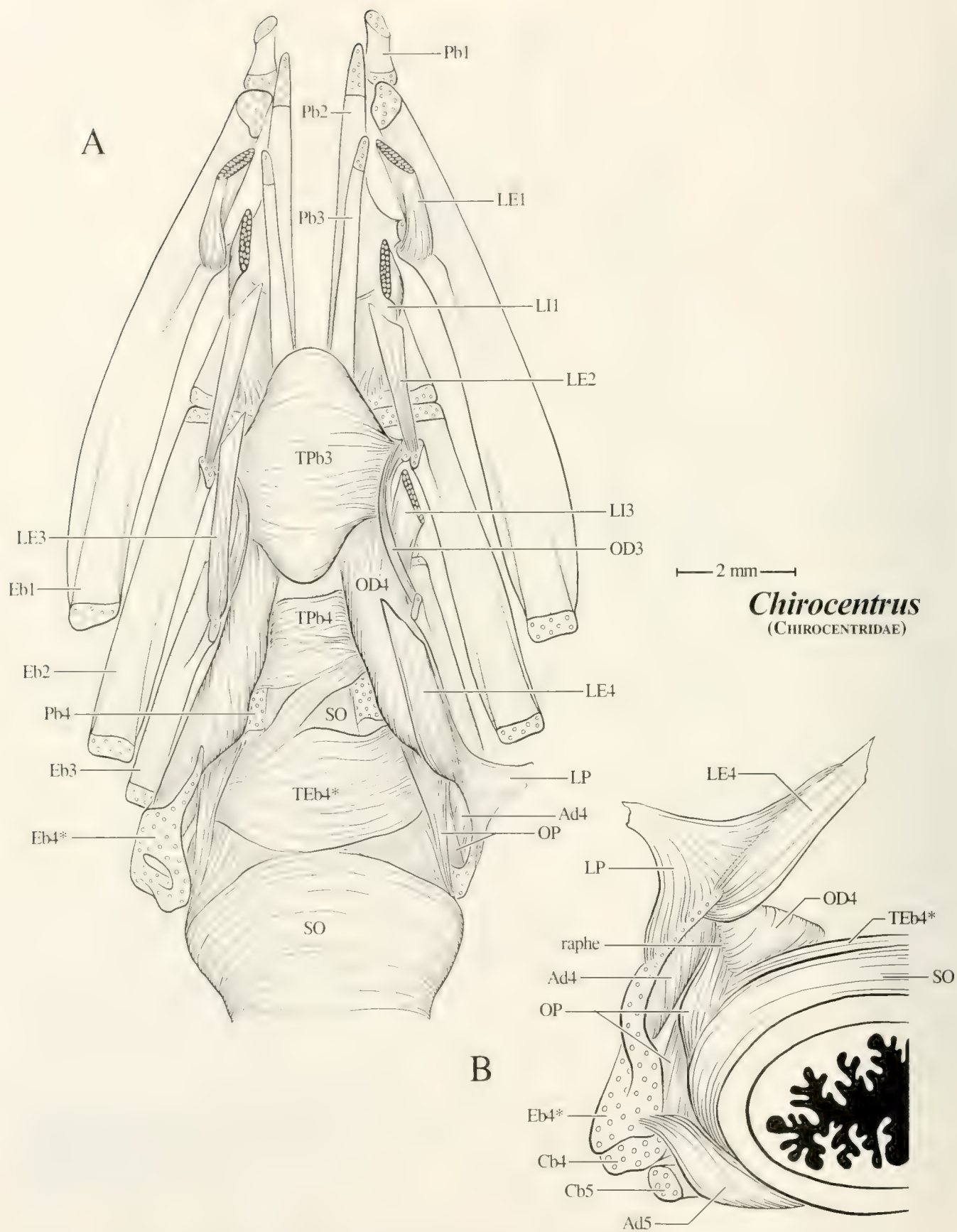




*Coilia*  
(ENGRAULIDAE)

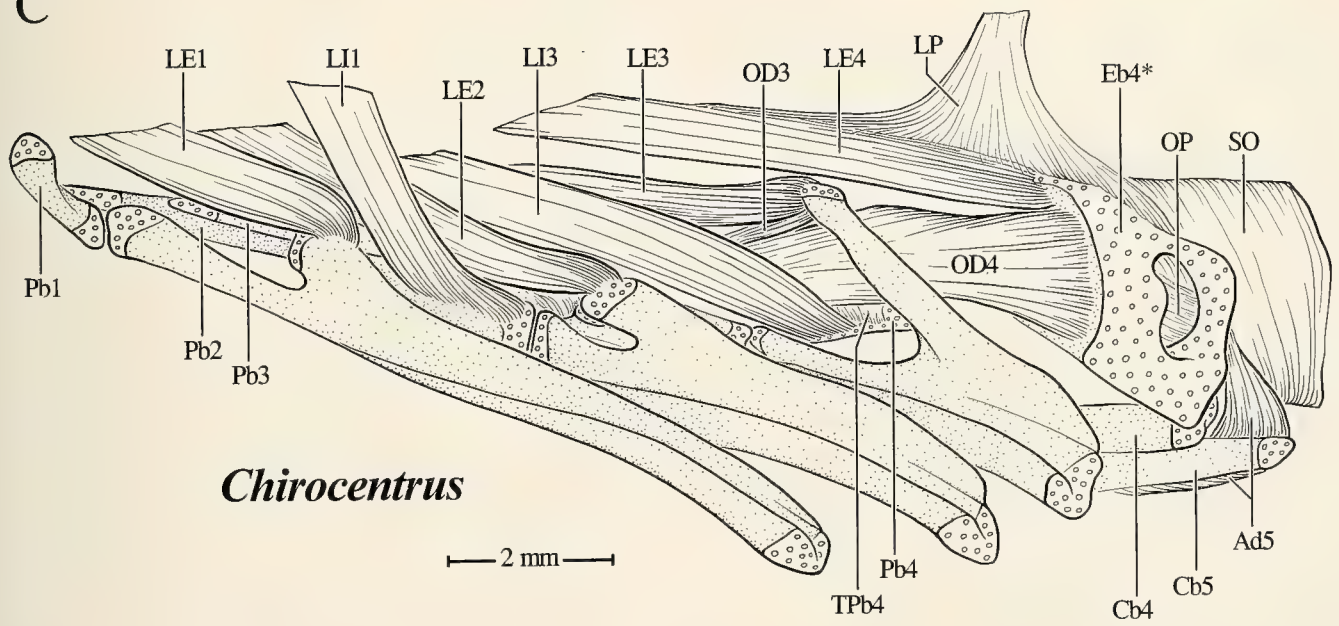
B





Plates 28.1, 28.2. *Chirocentrus dorab*, USNM 283241: A, dorsal view, left-side LE4 and LP removed, right-side LE3 removed; B, posterior view, right side reversed; C, lateral view, right side reversed.

C



*Chirocentrus*





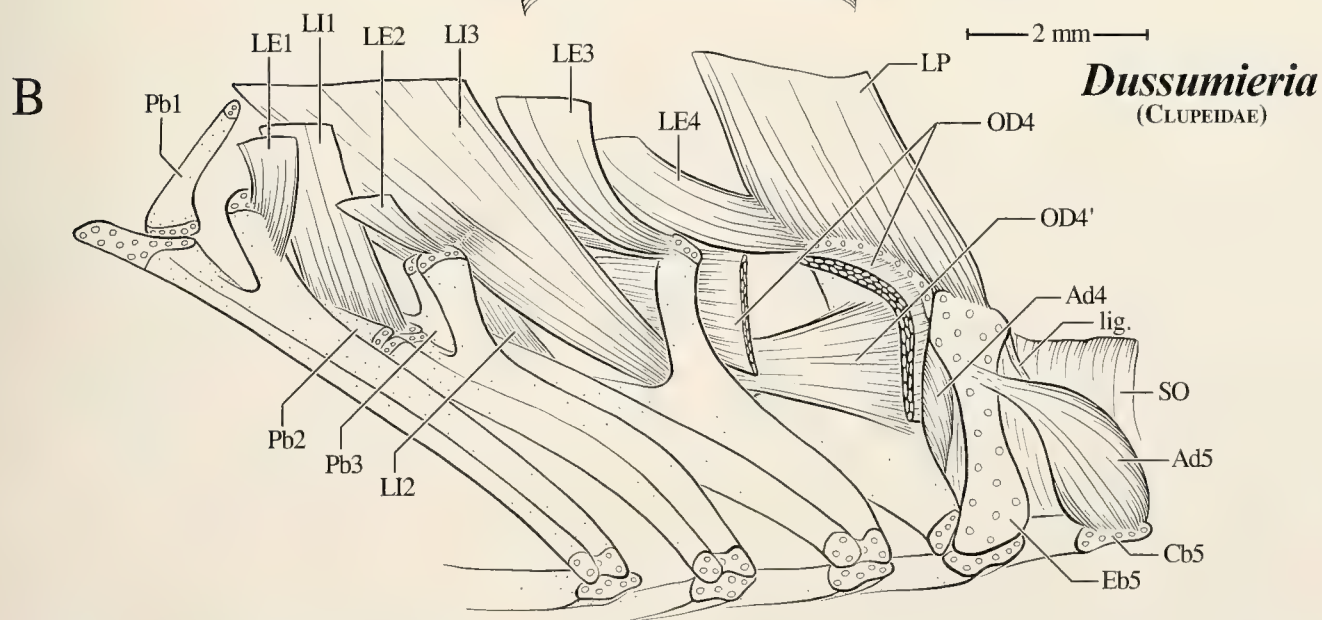
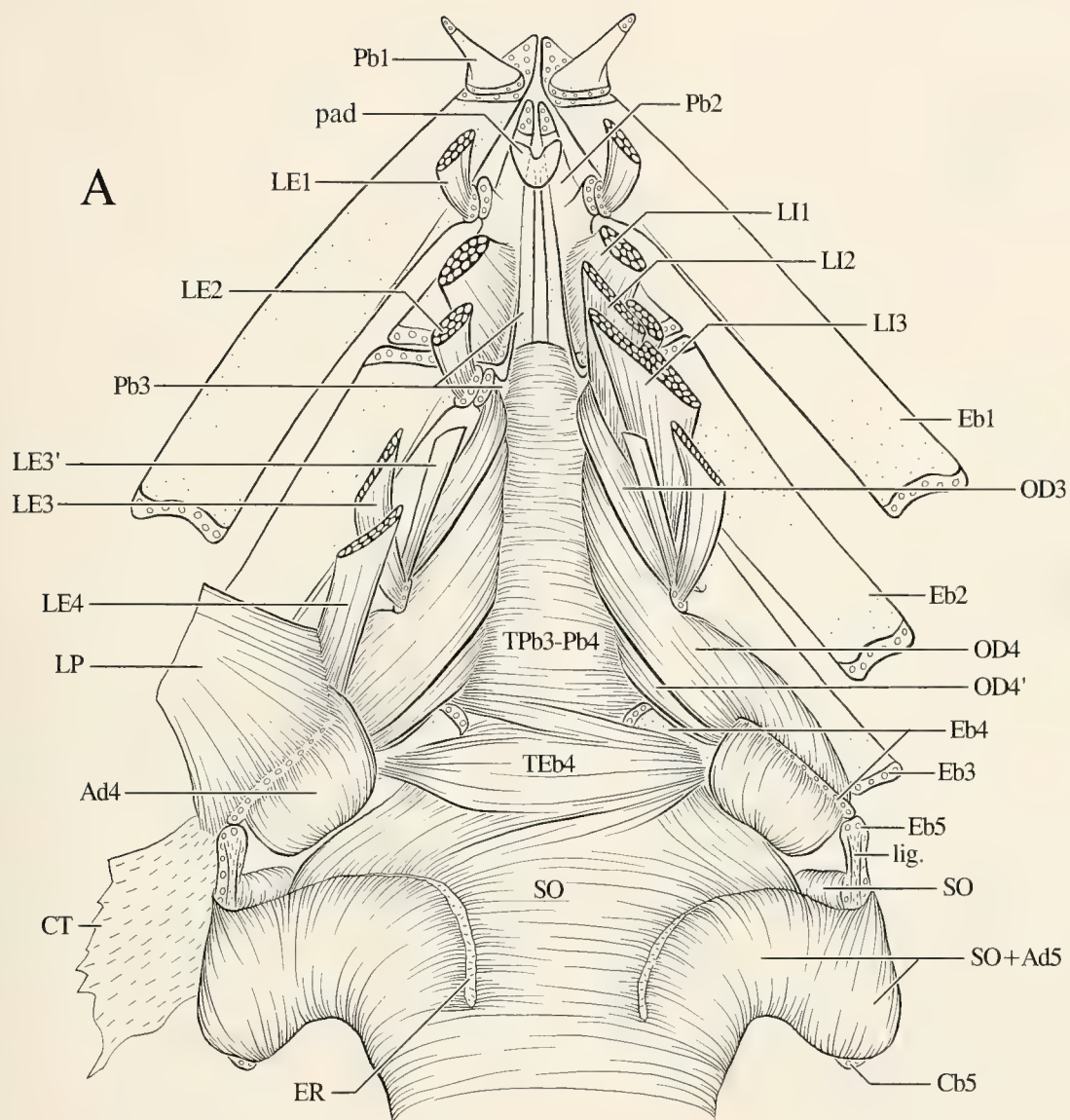


Plate 29. *Dussumieria acuta*, USNM 296827: A, dorsal view, left-side LI2 and LI3 removed to reveal LE2 insertion; tissue composition of pad overlying dorsoanterior ends of Pb2s and Pb3s is unknown; B, lateral view, left side, OD4 cut away to expose OD4'.



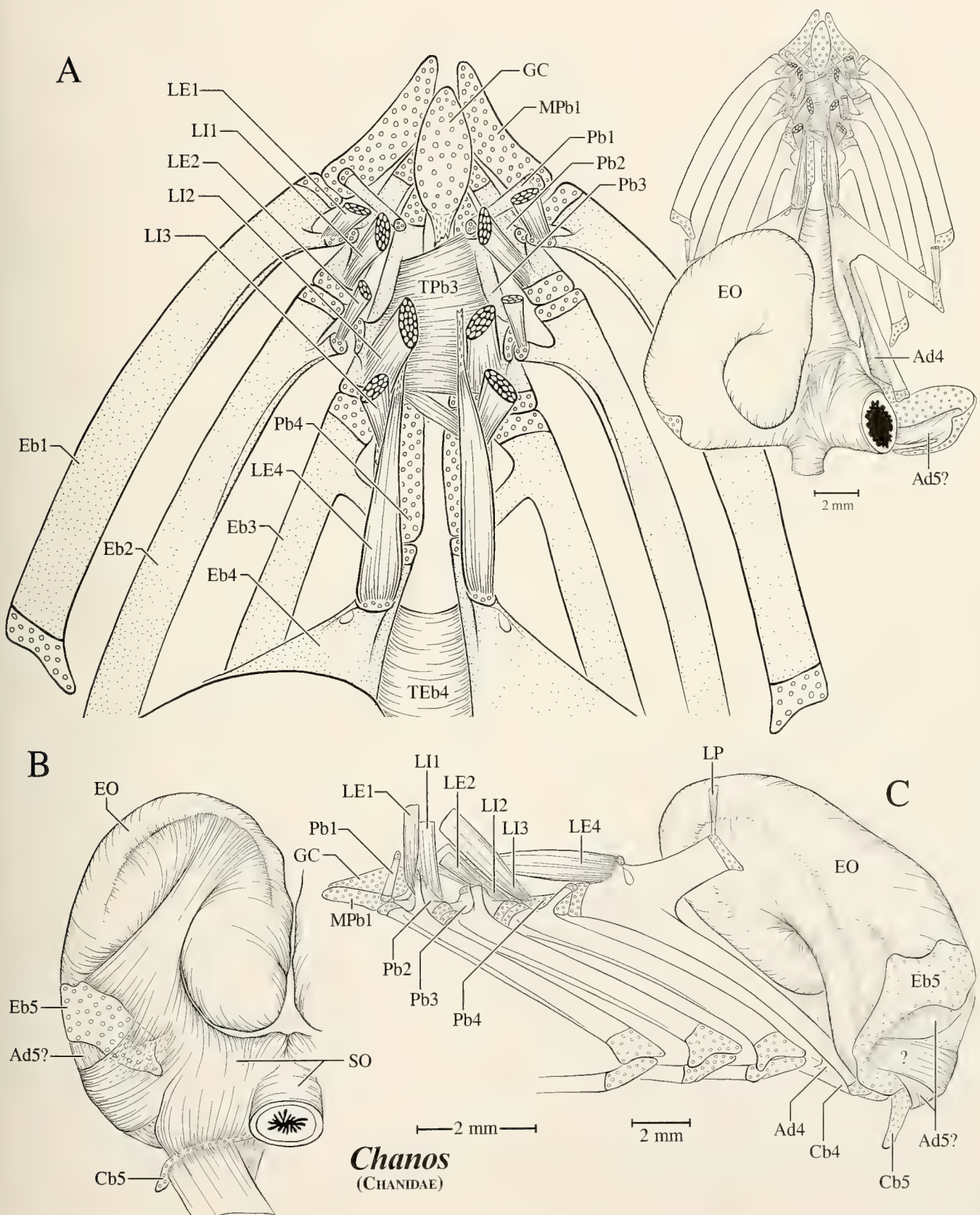
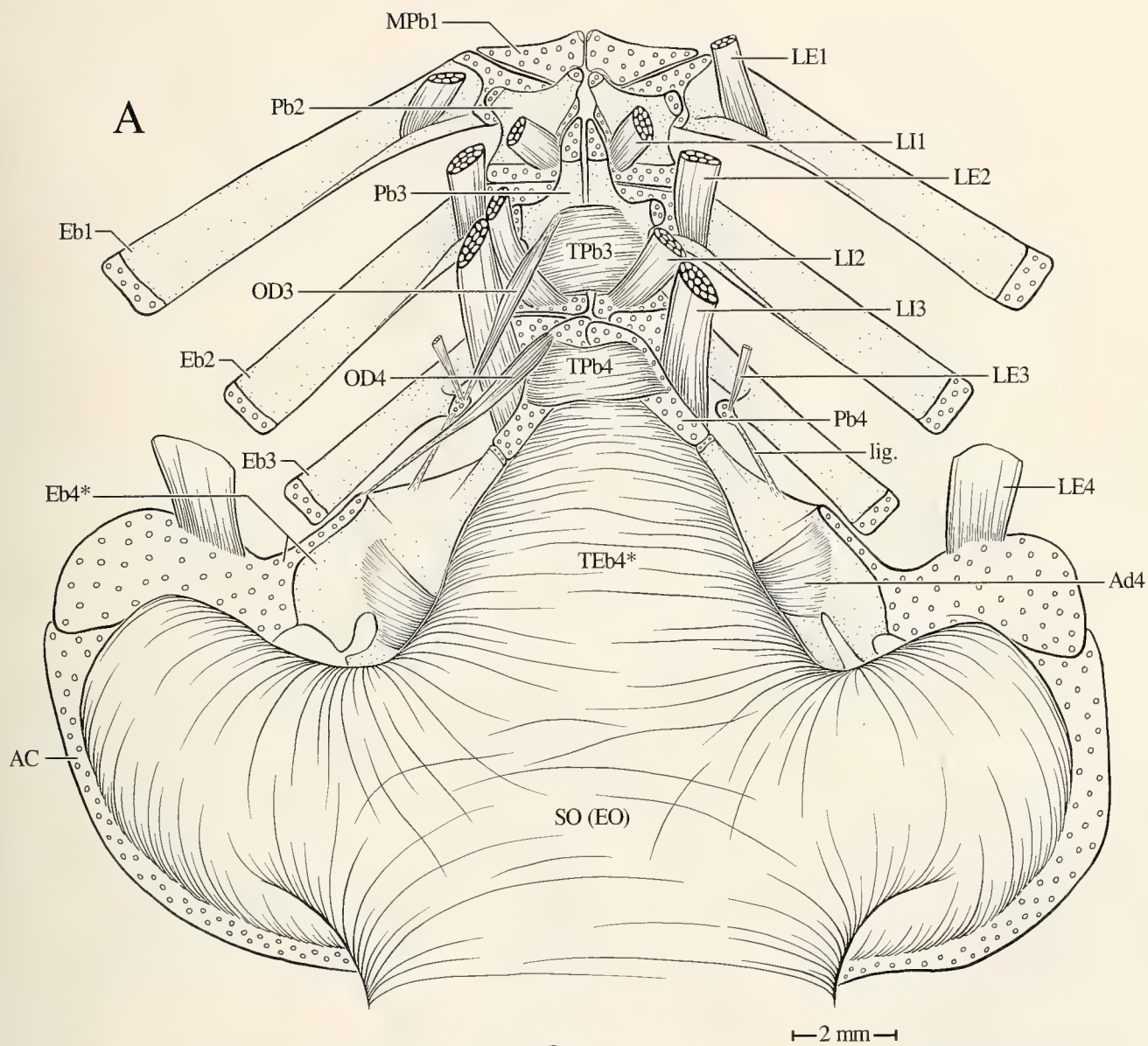


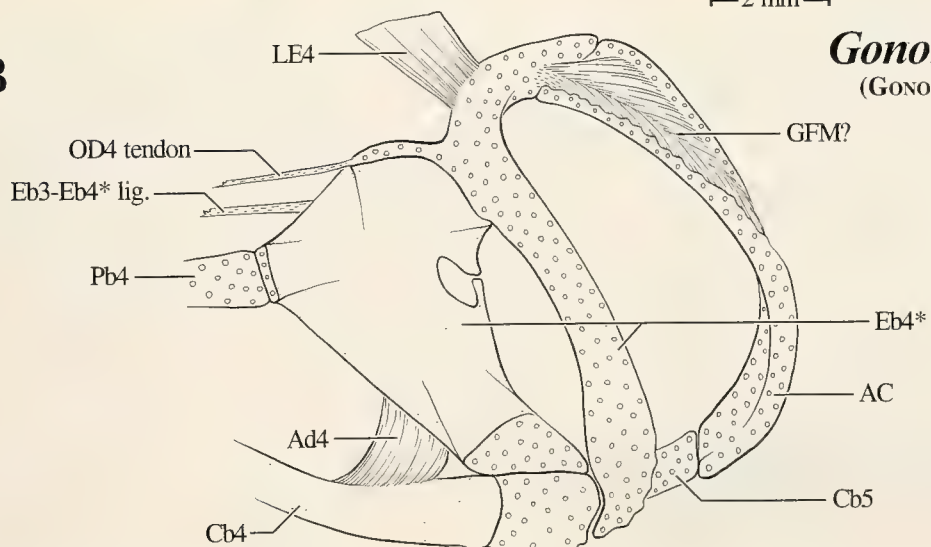
Plate 30. *Chanos chanos*, USNM 173572: A, dorsal views; left, enlarged anterior portion of gill arches and, right, reduced overall view, right epibranchial organ removed; B, posterior view, left side; C, lateral view, left side.





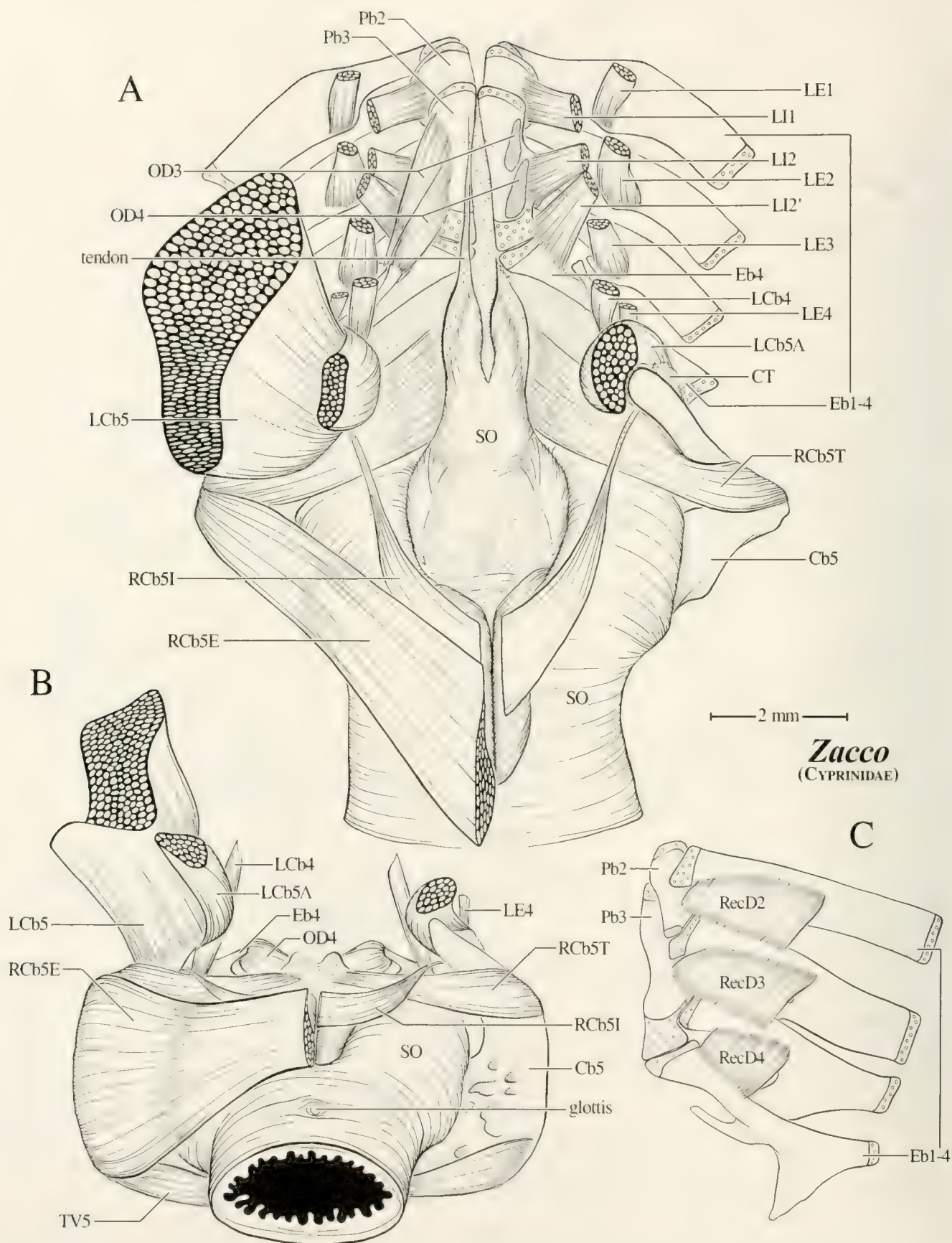


**B**



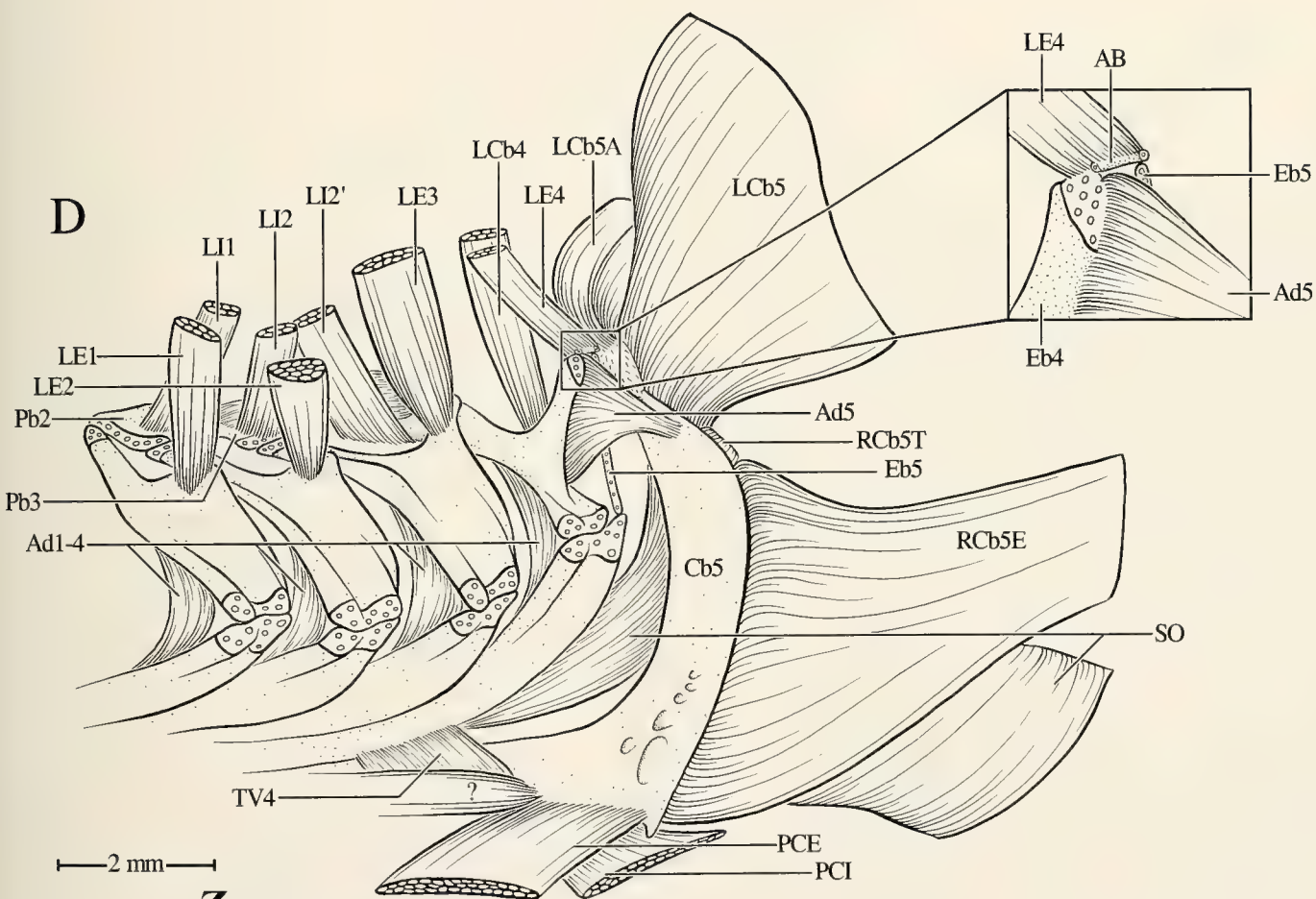
***Gonorhynchus***  
(GONORYNCHIDAE)

Plate 31. *Gonorhynchus moseleyi* Jordan and Snyder, USNM 354590: A, dorsal view, esophagus truncated, right-side OD3 and OD4 removed, sparse SO longitudinal fibers extending anteriorly from below TPb4 to below TPb3 not shown; B, lateral view, posterior gill-arch skeleton to show AD4. Identification of LE4 questionable; see remarks following LP in species description.



Plates 32.1, 32.2. *Zacco platypus*, USNM 336890: A, dorsal view: right-side RCb5E, LCb5, OD3, and OD4 removed (OD origins on Pb3 indicated by shaded areas); fascia covering dorsoanterior SO extensions greatly simplified, cut back on right side; SO longitudinal muscle layer not shown; B, posterior view, right-side RCb5E and LCb5 removed; C, ventral view, right-side dorsal gill-arch skeleton showing RecD2, 3, and 4; D, lateral view, left side (enlarged inset shows autogenous bone, AB, at dorsal tip of Eb4 levator process).

D



*Zacco*





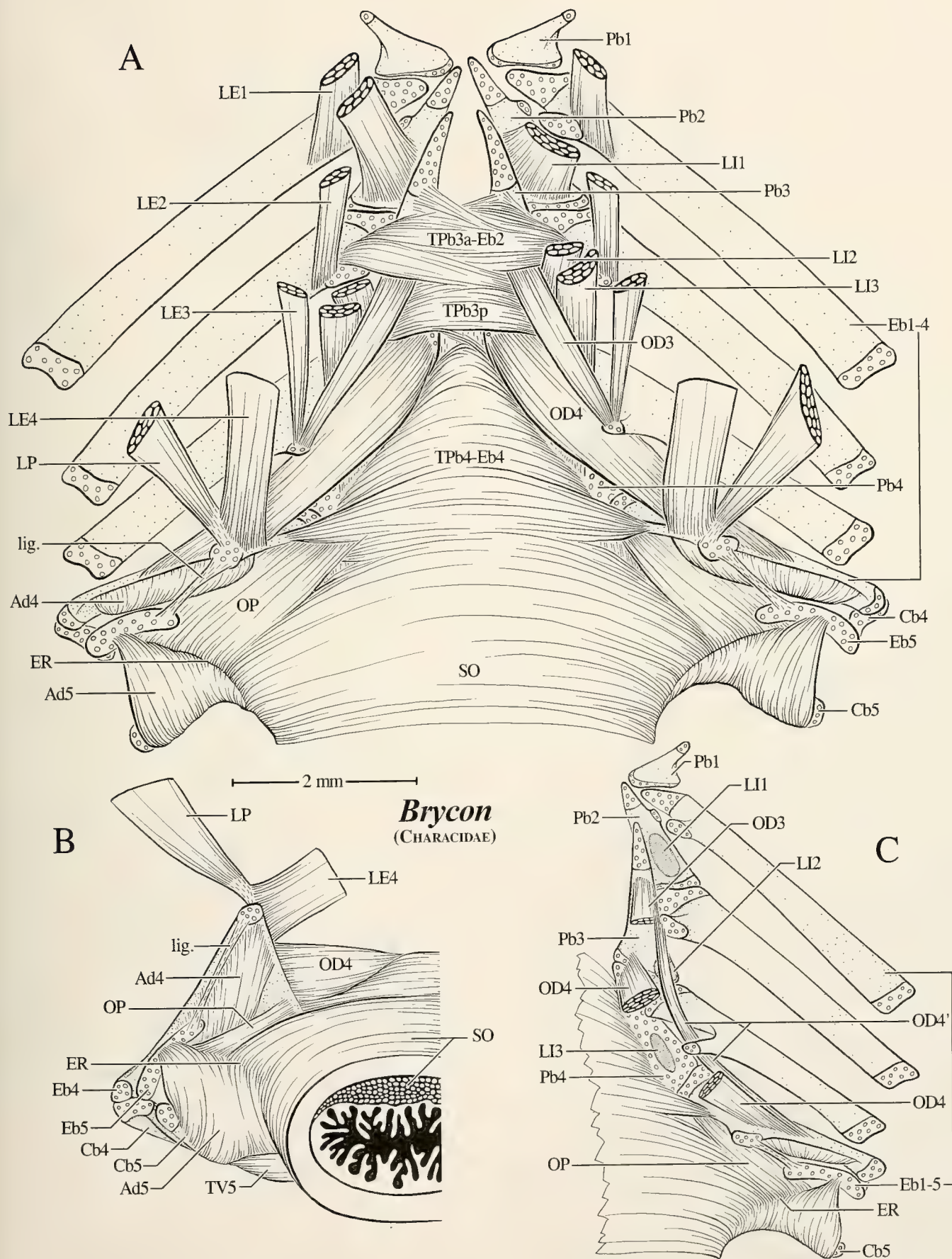
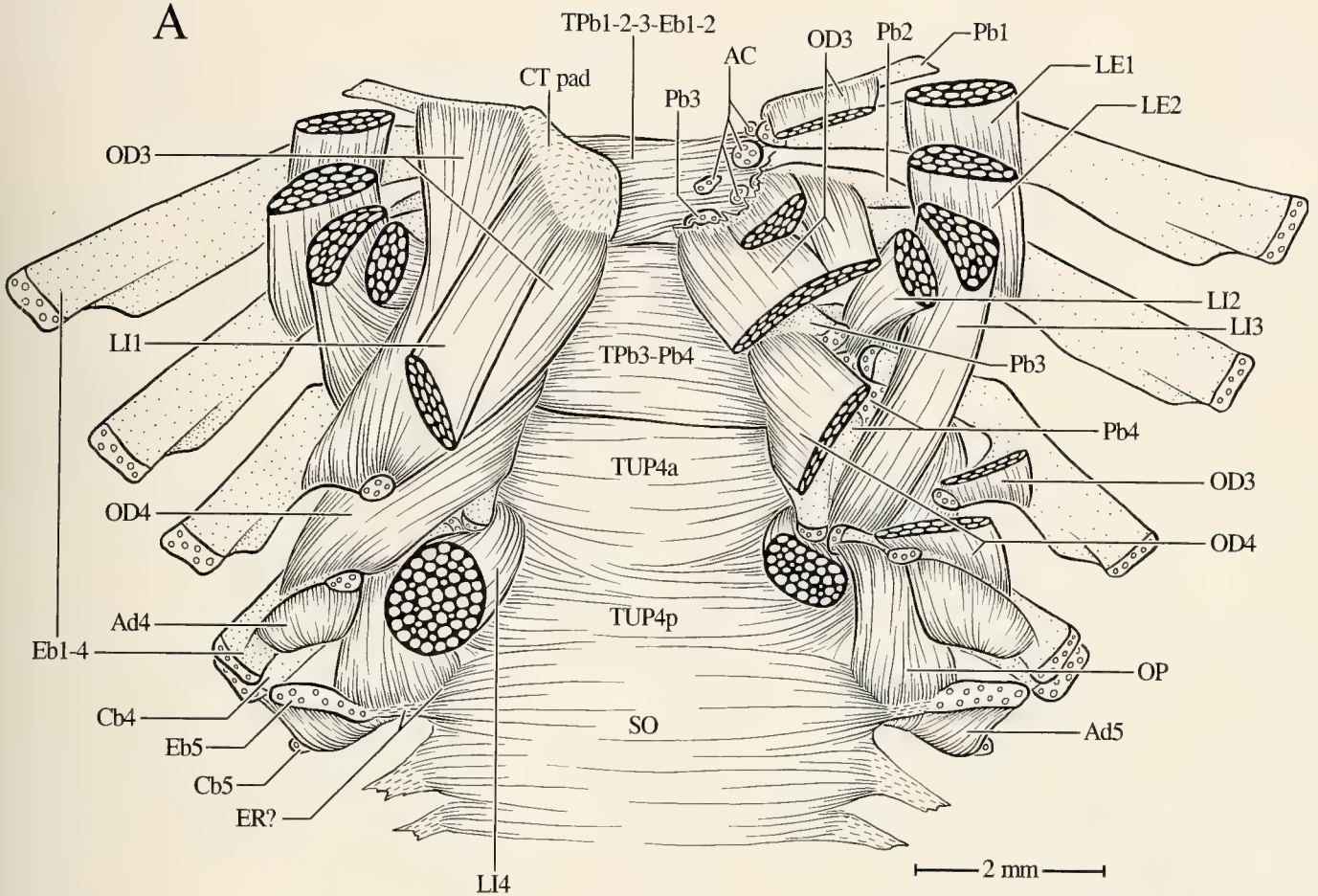


Plate 33. *Brycon guatemalensis*, USNM 114526: A, dorsal view; B, posterior view, left side; C, dorsal view of right-side dorsal gill arches, LI1-3 (insertion areas indicated), LE2 and 3 removed, and OD3 and 4 cut away to expose OD4'. Note: OD4' absent in *B. melanopterus*.

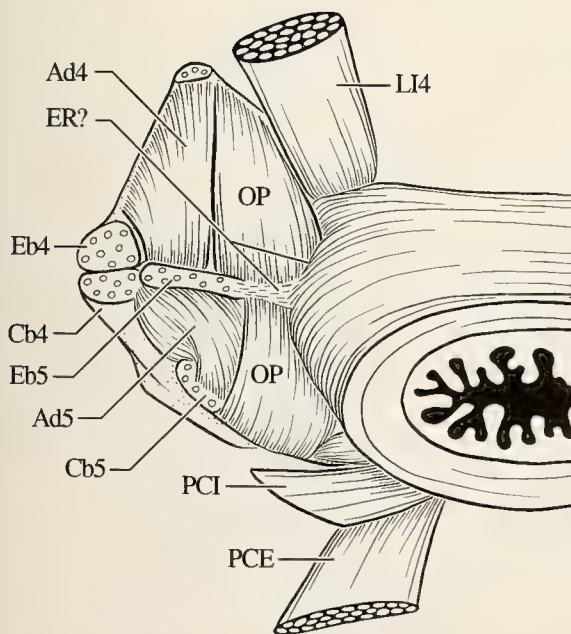


A



*Diplomystes*  
(DIPLOMYSTIDAE)

B



C

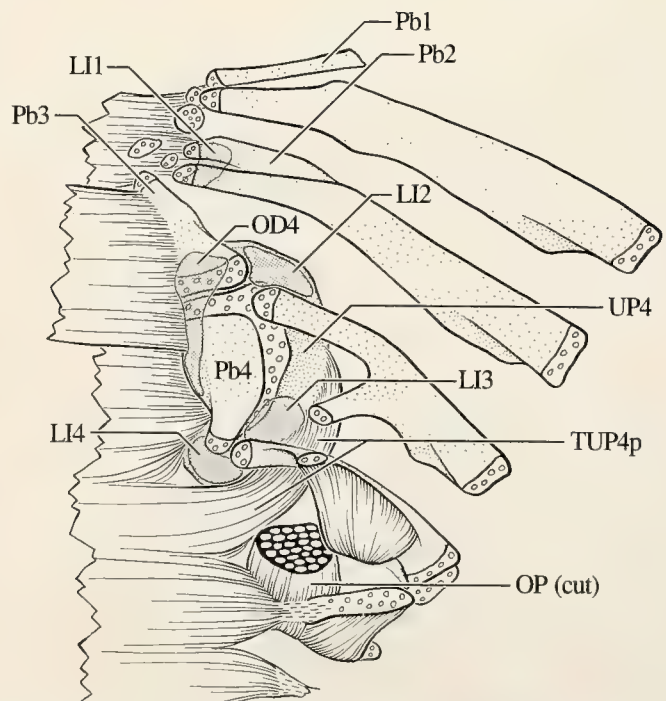
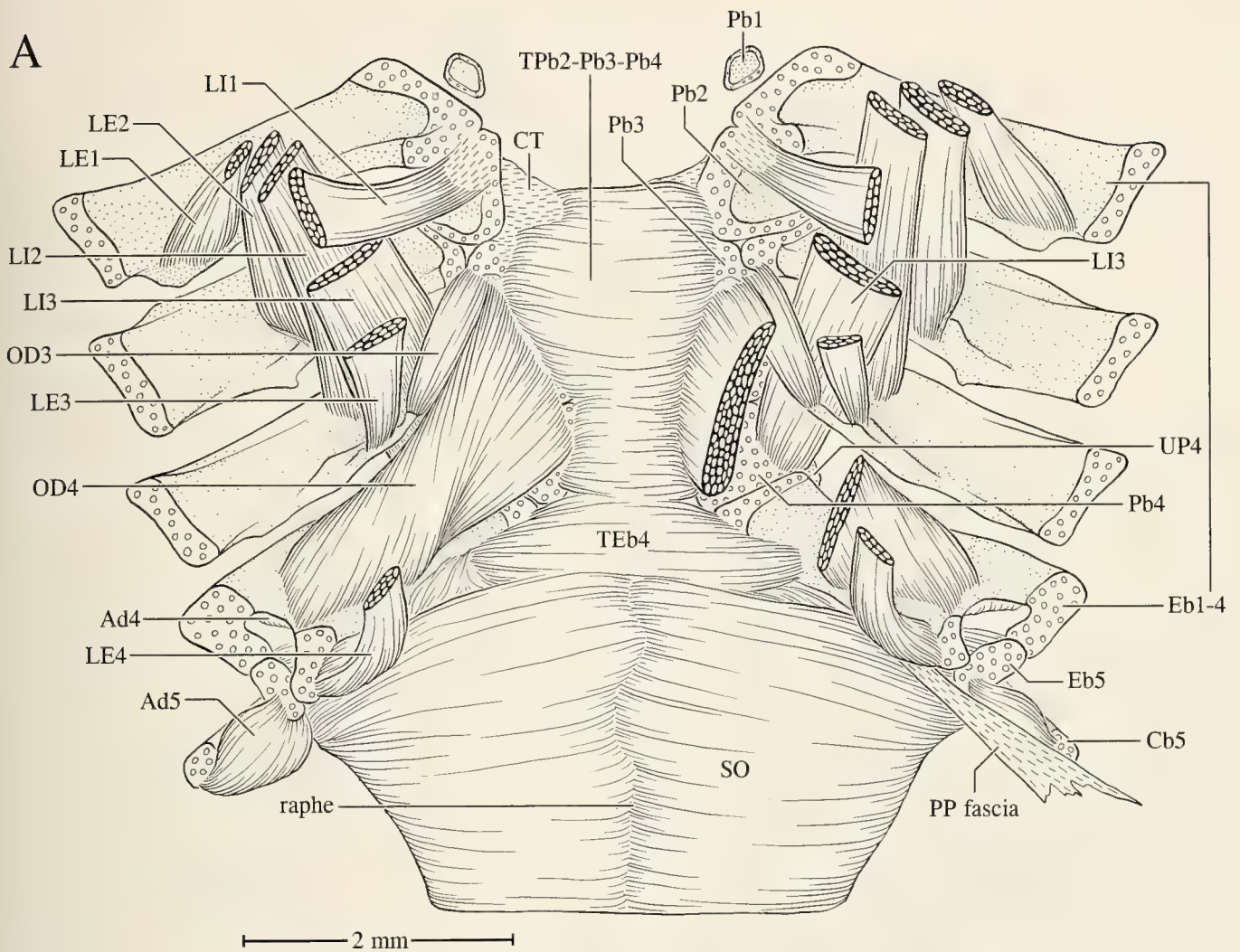


Plate 34. *Diplomystes chilensis*, USNM 259097: A, dorsal view, right-side anterior CT cut away to expose cartilage; right-side OD3 and OD4 cut away to expose some underlying muscle-bone relationships; B, posterior view, left side; C, dorsal view, levators and dorsal obliques removed, but insertions of LI1-4 and origin of OD4 indicated.







***Gymnotus***  
(GYMNOTIDAE)

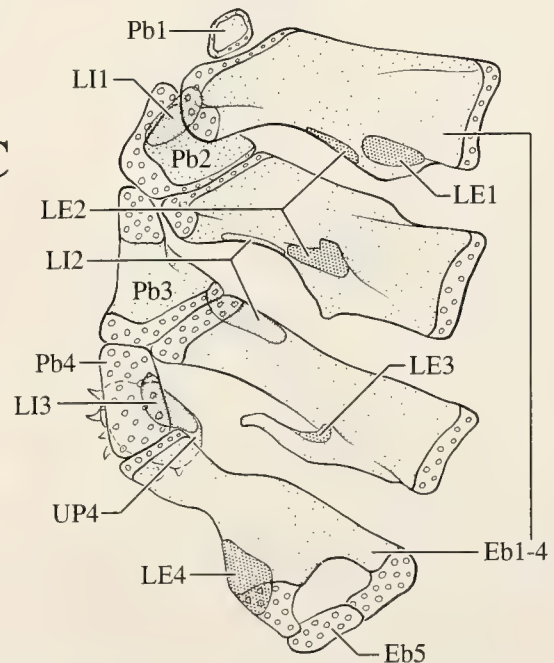
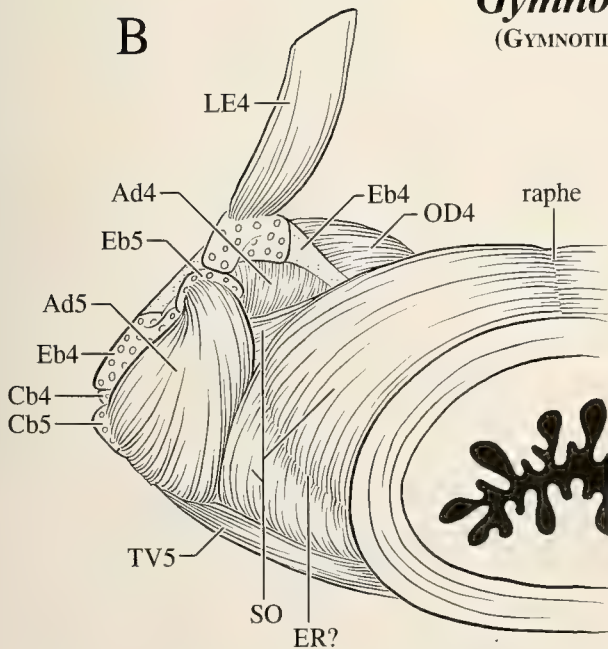


Plate 35. *Gymnotus carapo*, A, B, USNM 260272: A, dorsal view, right-side OD4 cut away, left-side PP fascia removed (Pb1 based on USNM 233851); B, posterior view, left side; C, USNM 233851 (cleared and stained), dorsal gill-arches with insertions of levators (based on USNM 260272) indicated by shaded areas.



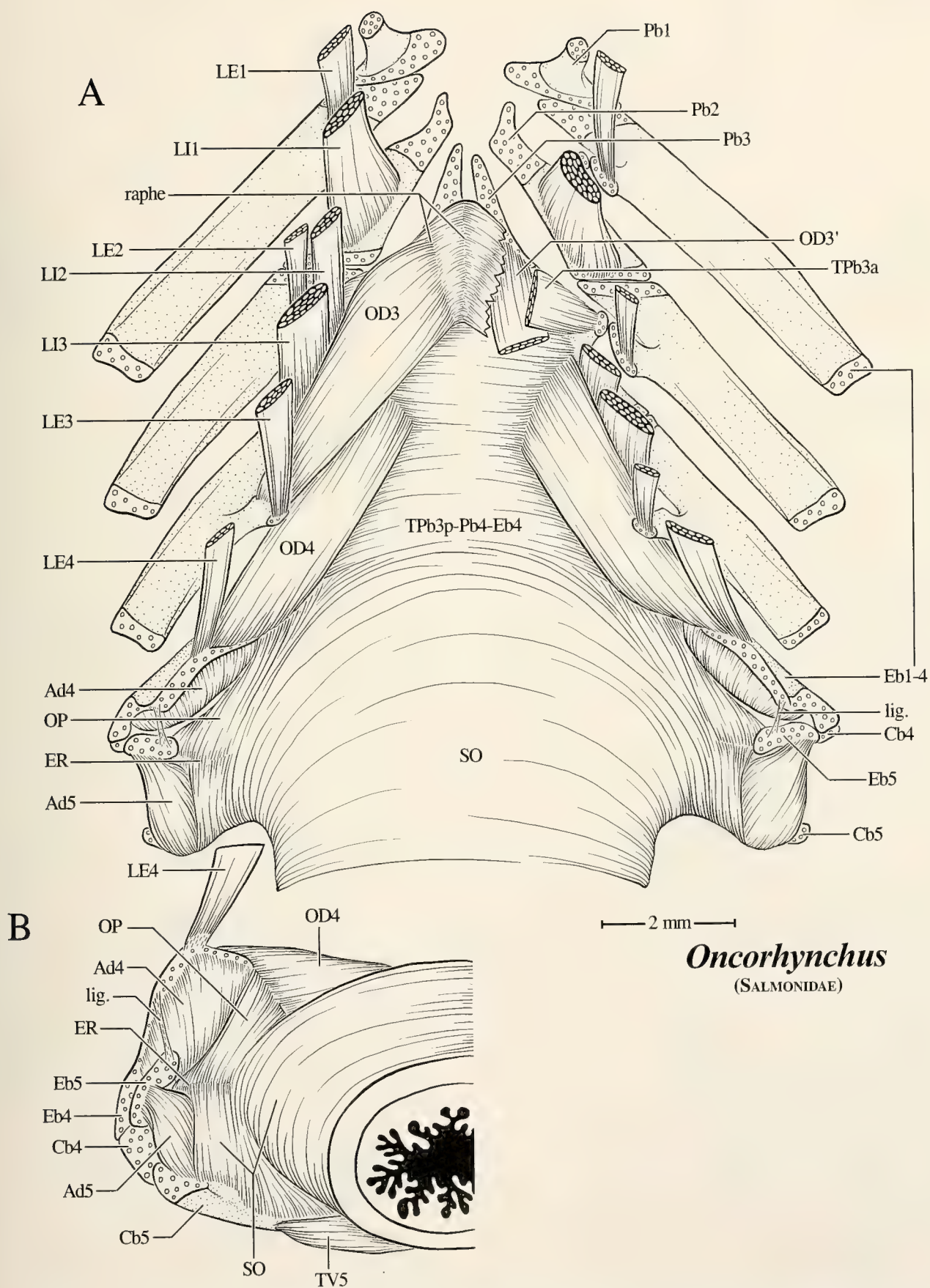


Plate 36. *Oncorhynchus mykiss*, USNM 351540: A, dorsal view, right-side OD3 cut away to reveal TPb3a, which joins anteroventral surface of OD3; TPb3a cut away to reveal origin of OD3', which joins mid-ventral surface of OD3; B, posterior view, left side.









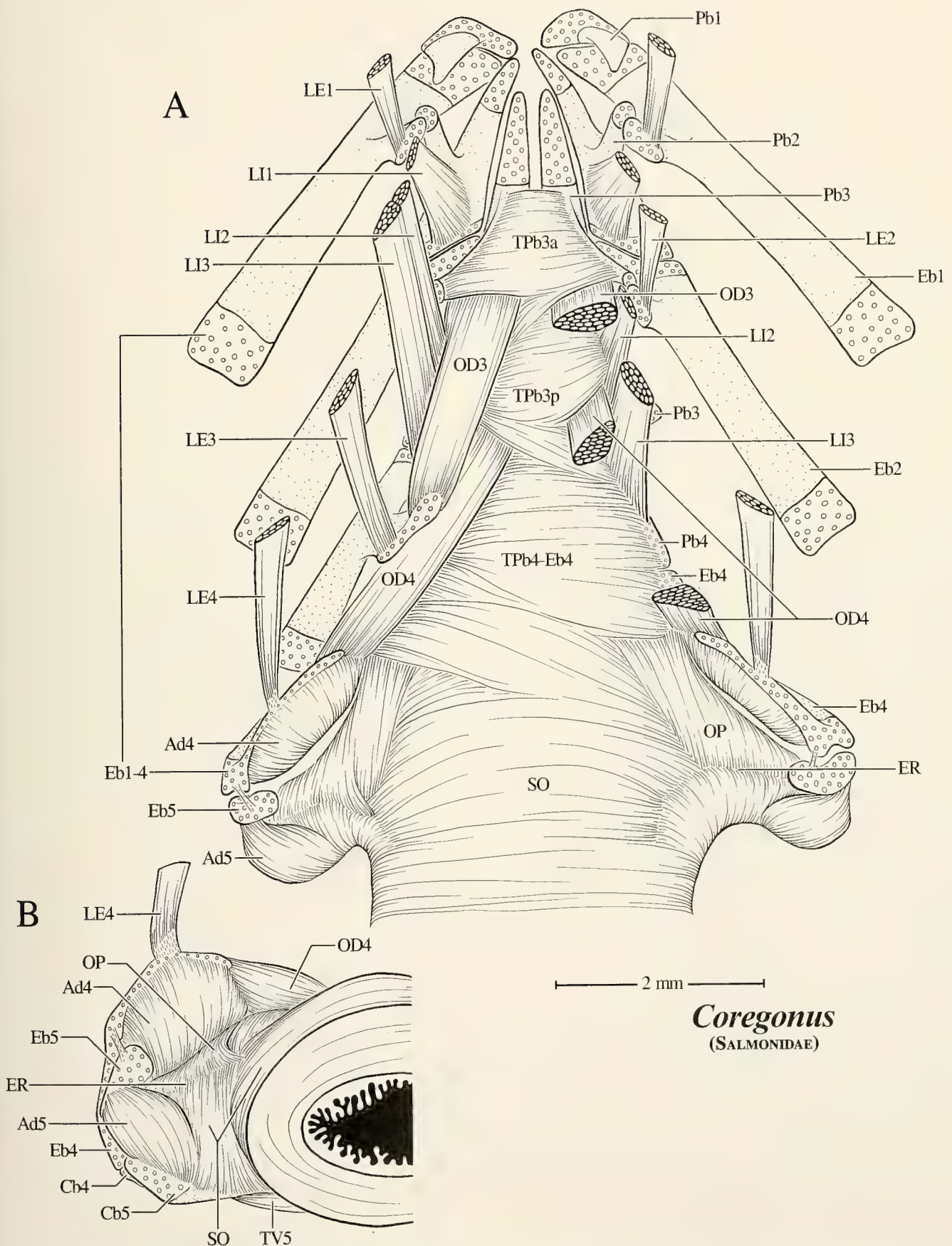


Plate 38. *Coregonus artedii*, USNM 117488: A, dorsal view, right-side Eb3 removed and OD3 (insertion not shown) and OD4 cut away; Pb1 extends dorsoposteriorly, has all bony tip dorsally; B, posterior view, left side.





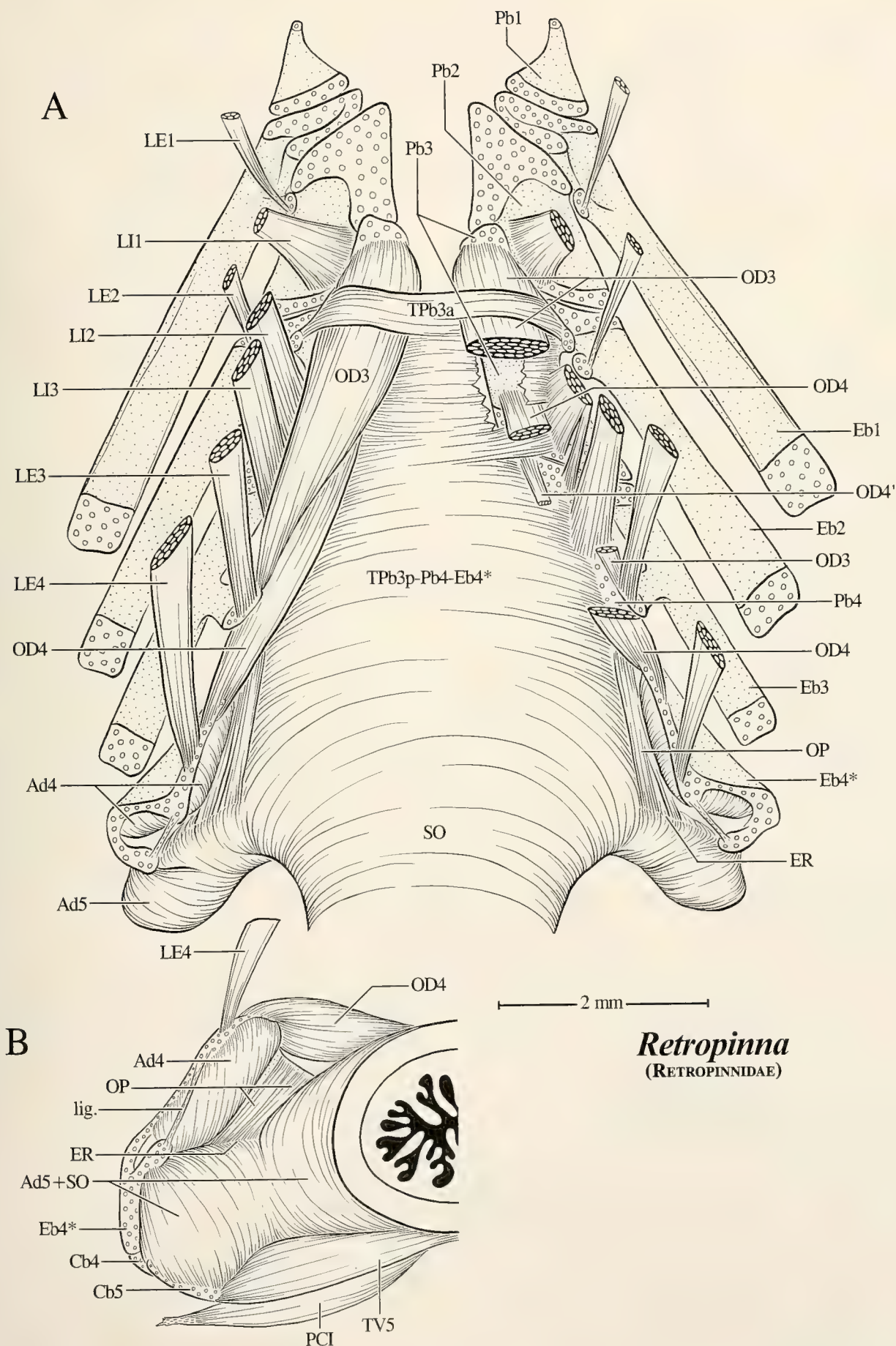


Plate 39. *Retropinna osmeroides*, USNM 304419: A, dorsal view, right-side TPb3p, OD3, OD4, and OD4' cut away to reveal origins of OD4 (on Pb3) and OD4' (on Pb4), insertions of LI2 and LI3, and attachment of TPb4-Eb4; B, posterior view, left side.



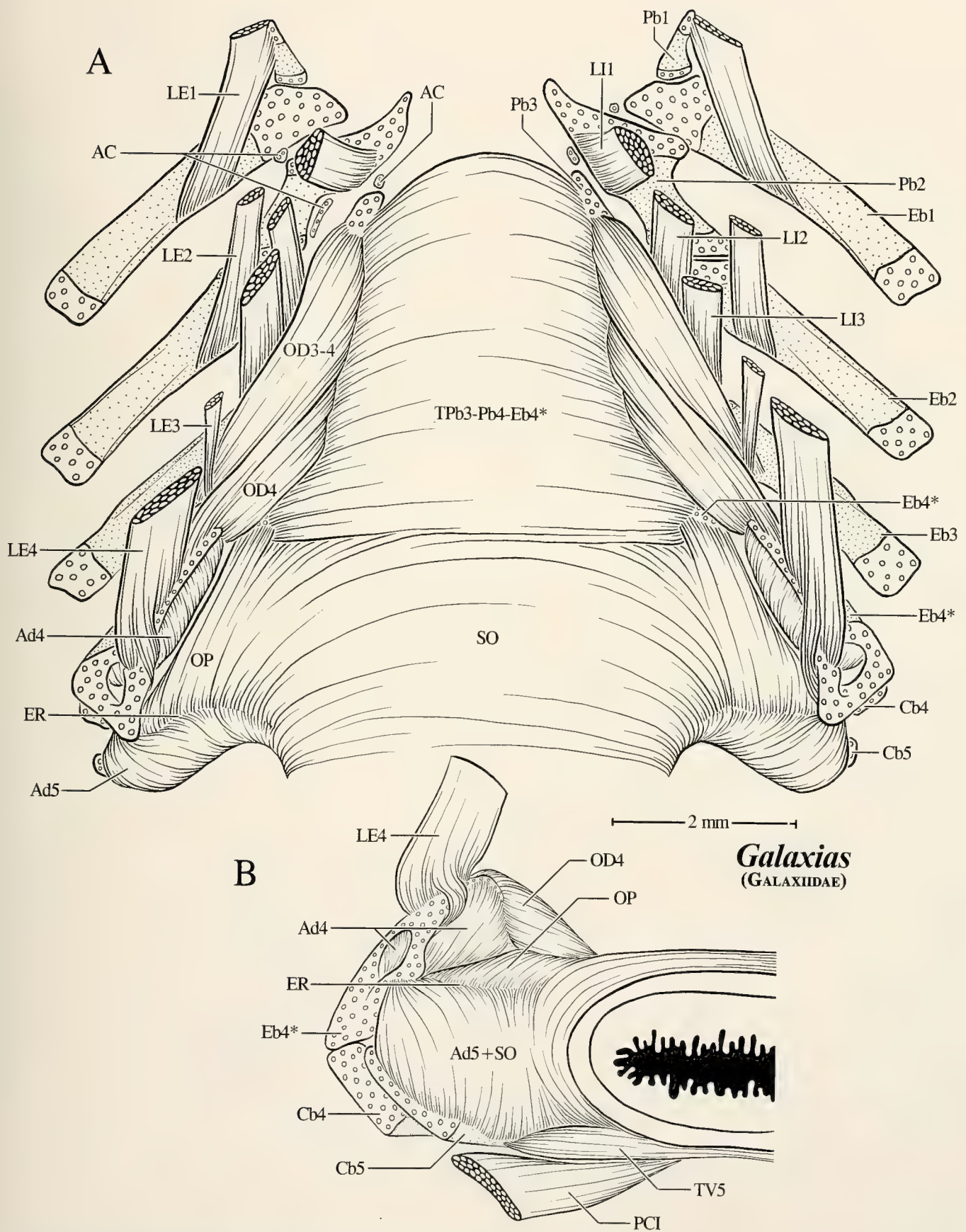


Plate 40. *Galaxias auratus*, USNM 344888: A, dorsal view; B, posterior view, left side.





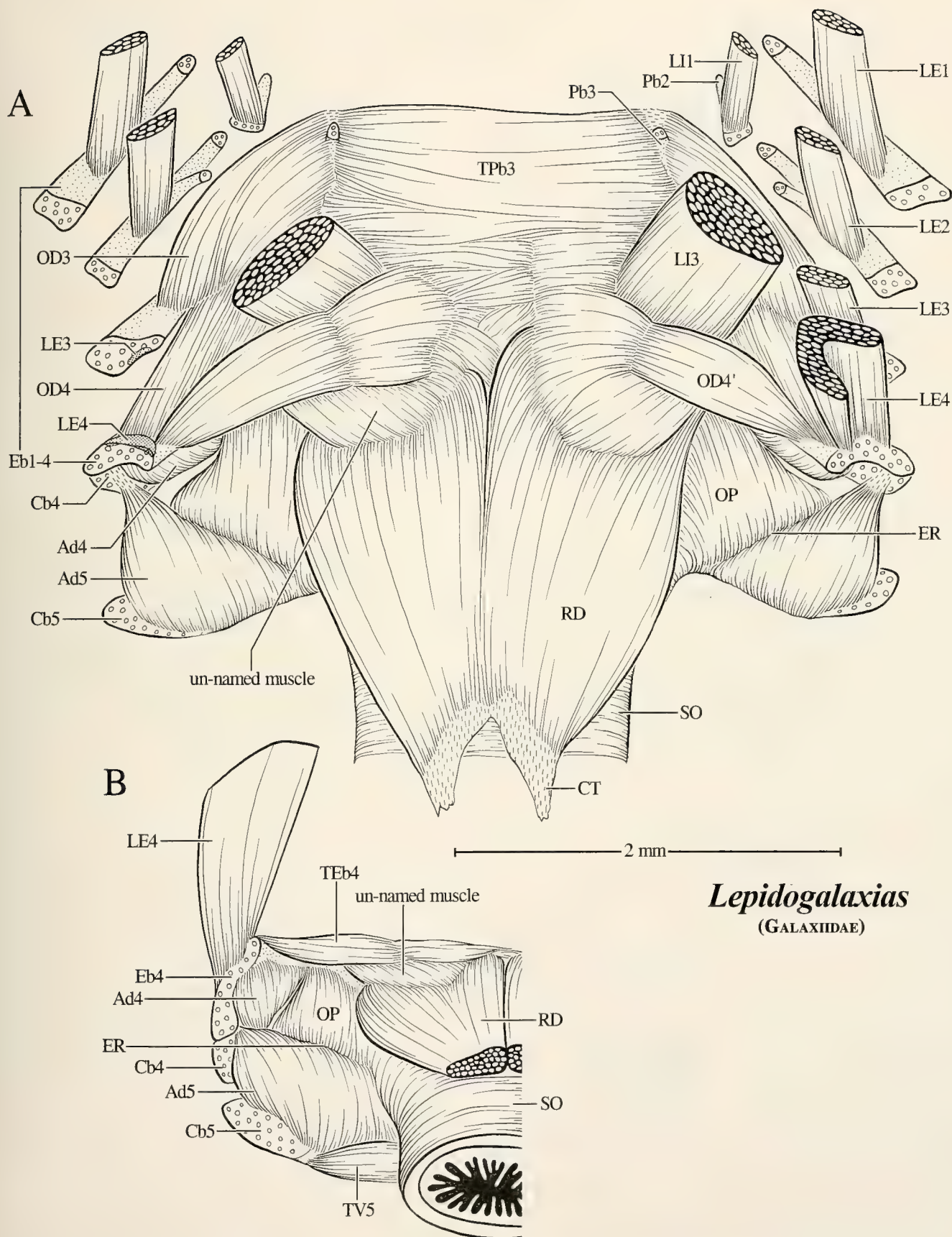
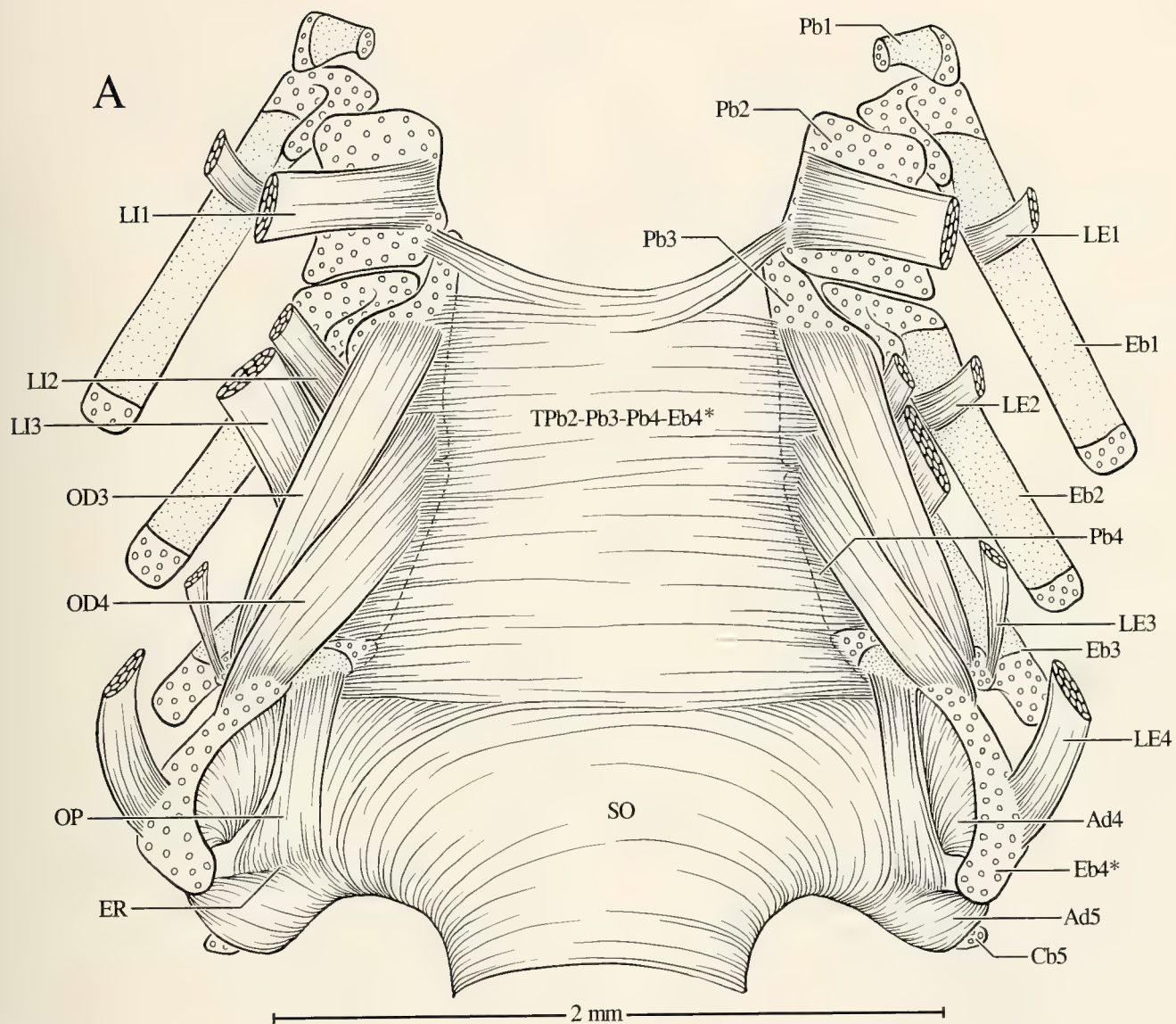


Plate 41. *Lepidogalaxias salamandroides*, USNM 358461: A, dorsal view, left-side LE3 and LE4 removed, insertion areas indicated; B, posterior view, left side.





*Lovettia*  
(GALAXIIDAE)

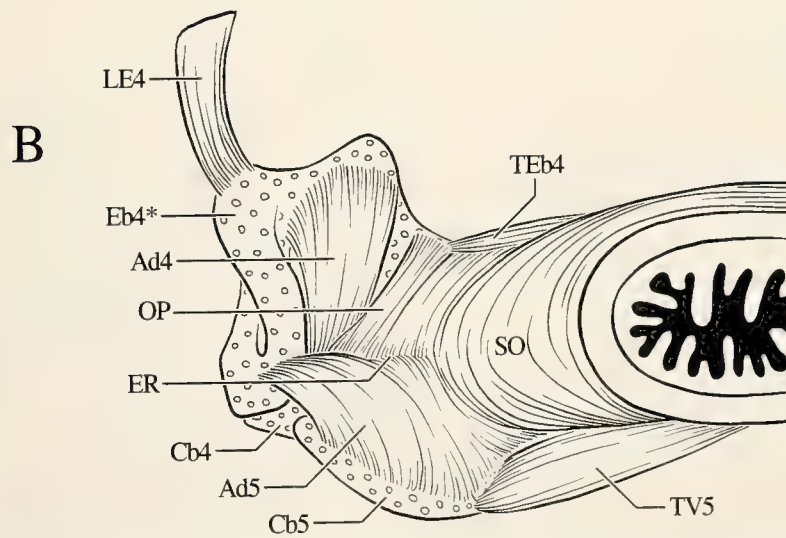


Plate 42. *Lovettia sealei*, USNM 358617: A, dorsal view, right-side LI2 and LI3 especially truncated to reveal LE2; B, left side, posterior view.





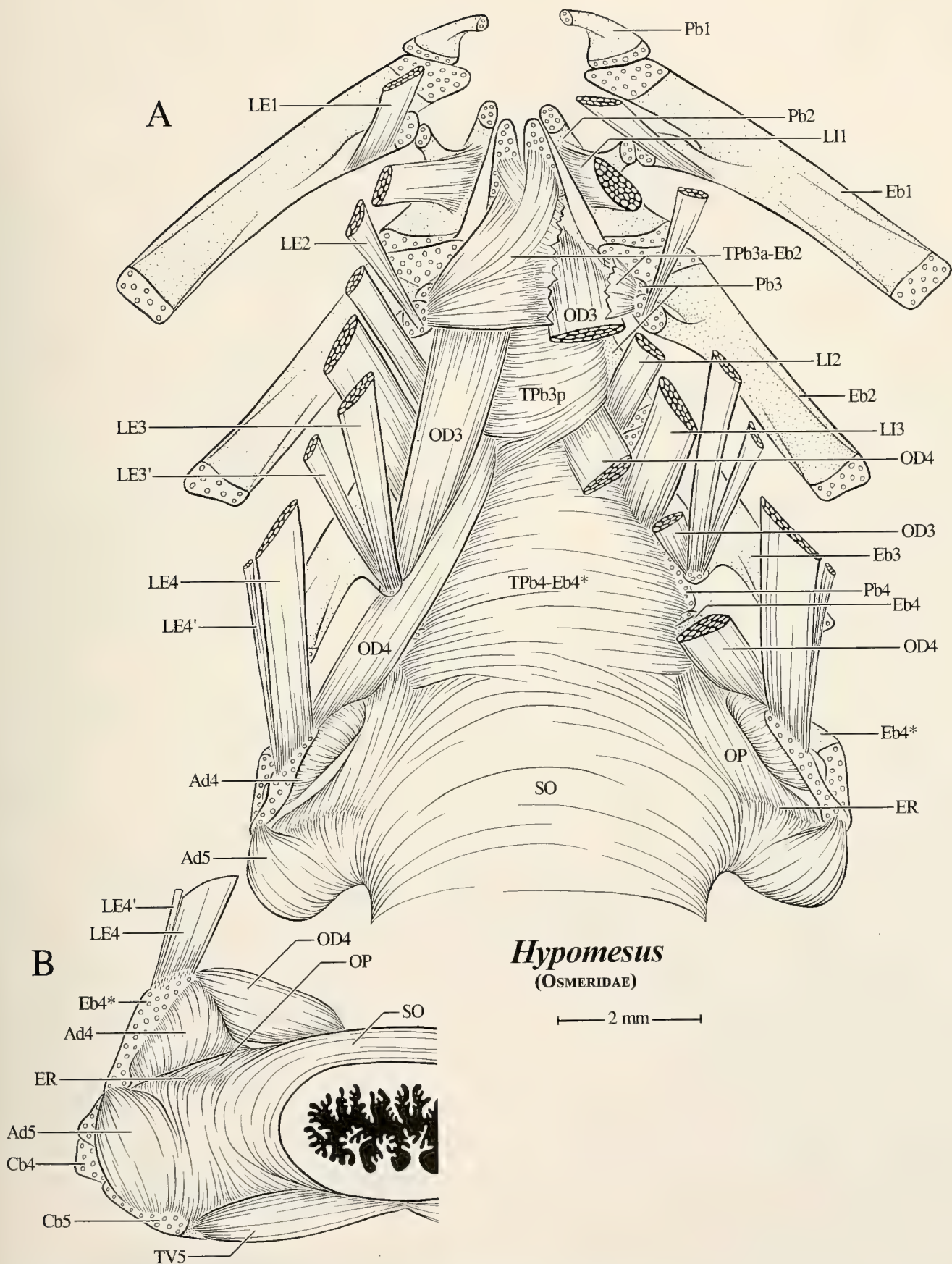
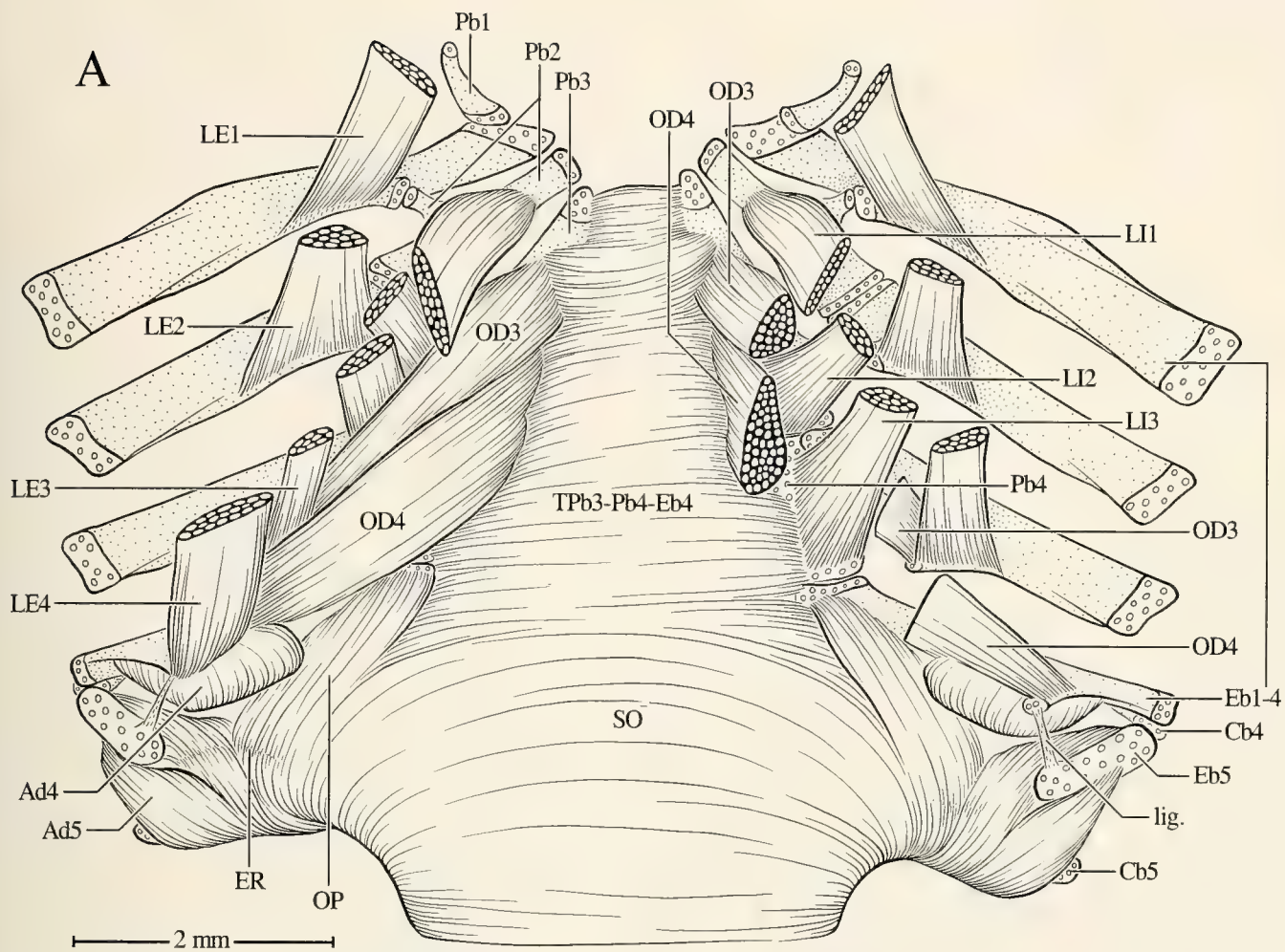


Plate 43. *Hypomesus pretiosus*, USNM 357404: A, dorsal view, right-side TPb3a-Eb2 cut away to reveal OD3 origin on Pb3; right-side OD3 and OD4 cut away to reveal LI2 and LI3 insertions; B, posterior view, right side reversed.





**Argentina**  
(ARGENTINIDAE)

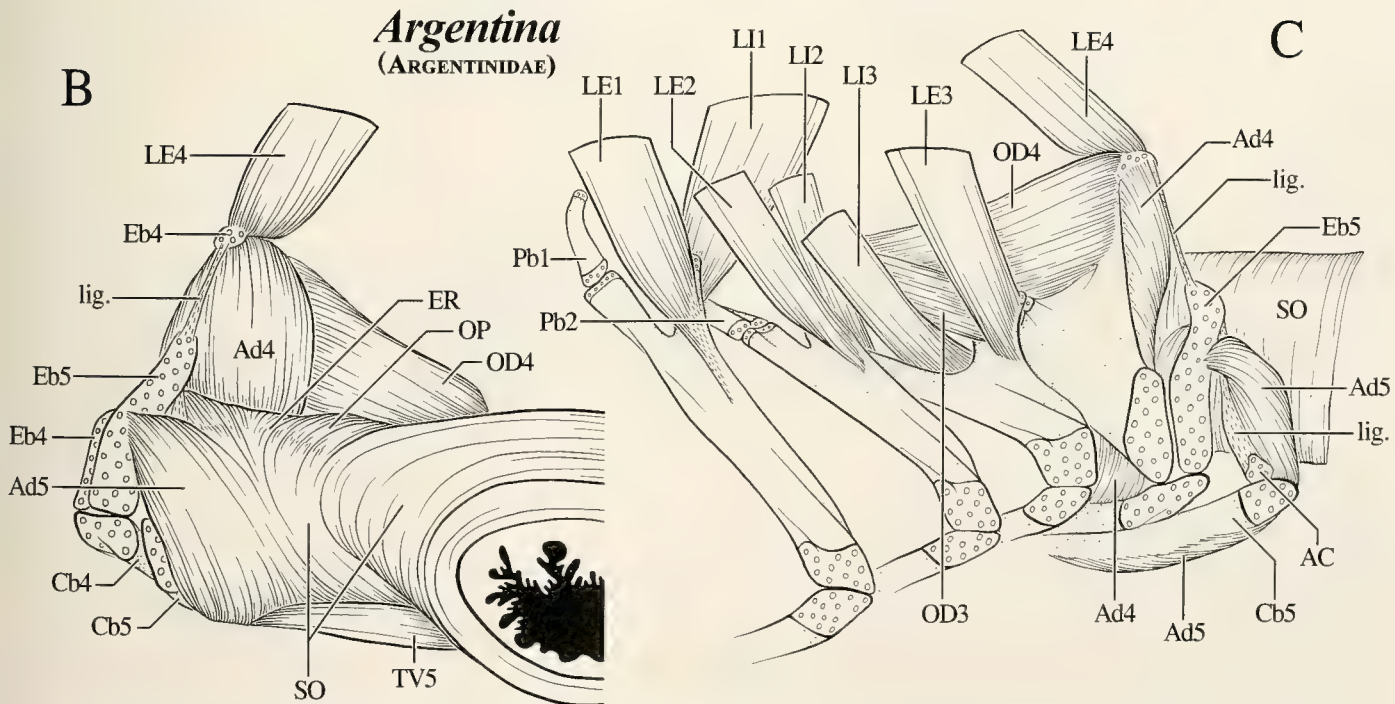
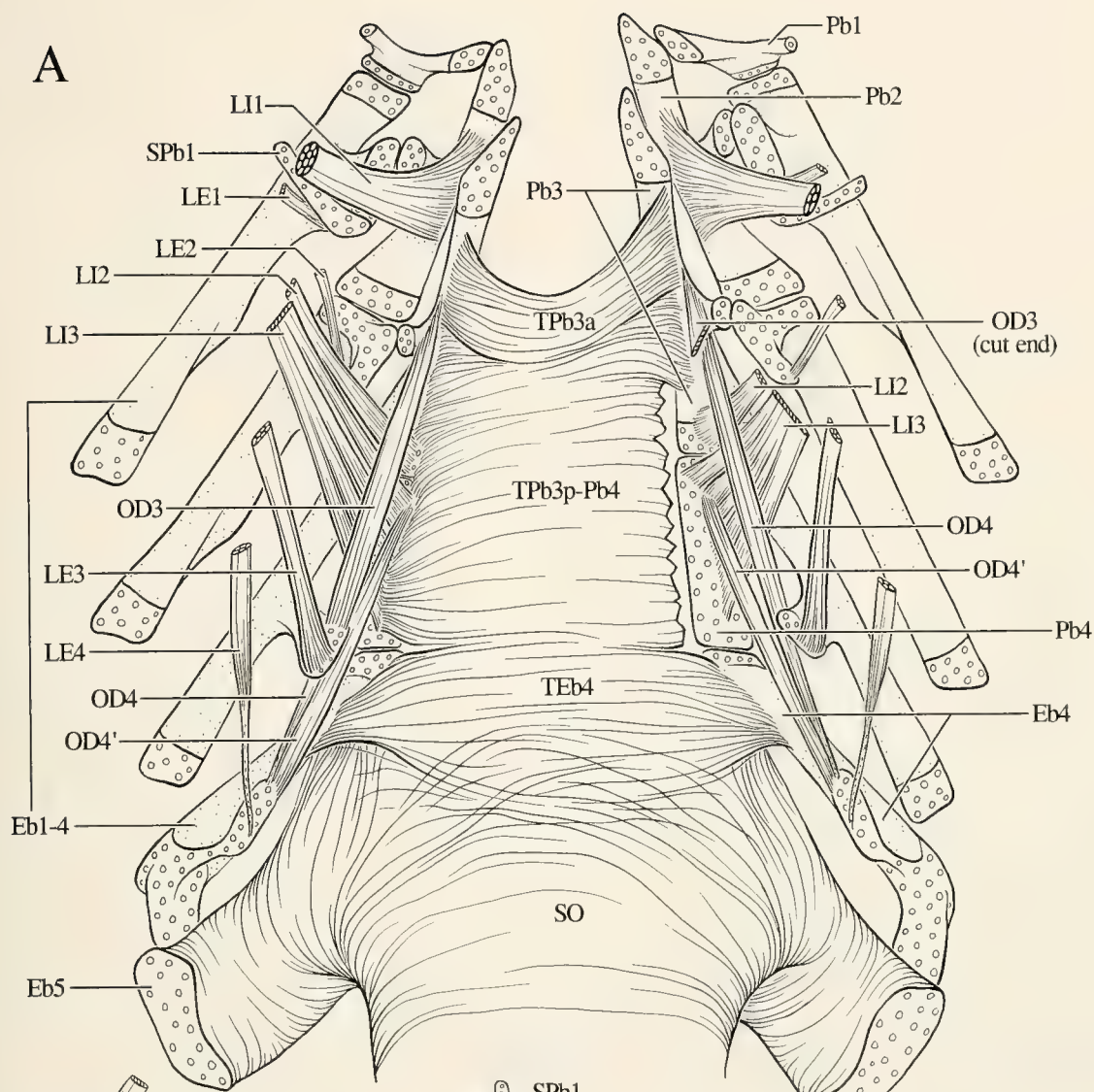


Plate 44. *Argentina brucei*, USNM 238005: A, dorsal view, right-side OD3 and OD4 cut away to reveal insertions of LI2 and LI3; right-side LE4 removed; B, posterior view, left side; C, lateral view, right side reversed.

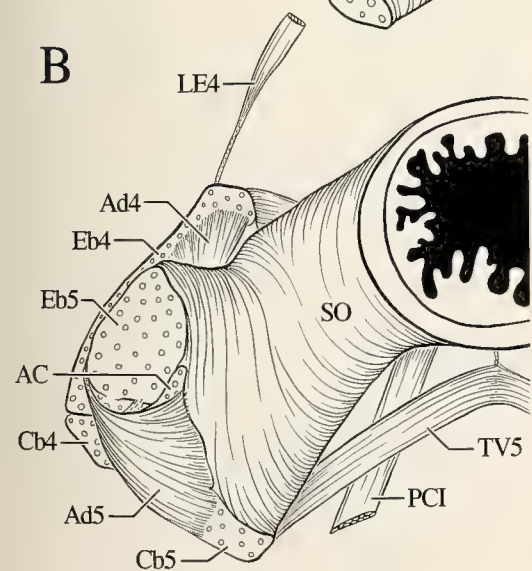




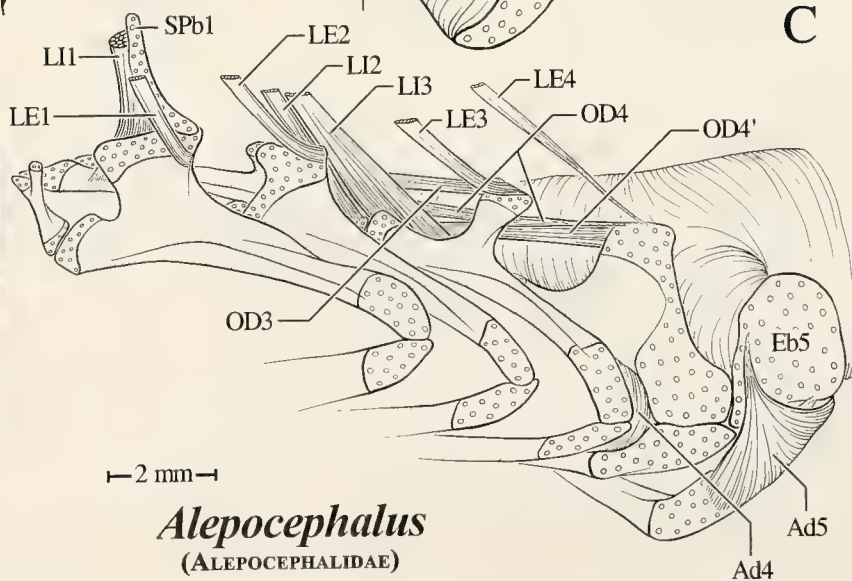
A



B



C



*Alepocephalus*  
(ALEPOCEPHALIDAE)

Plate 45. *Alepocephalus tenebrosus*, USNM 215582: A, dorsal view, right-side TPb3p-Pb4 and OD3 cut away to reveal Pb3 and Pb4 and insertions of LI2 and LI3; B, posterior view, left side, Ad5 occludes view of AC, tendon attaches AC to Eb5 ventromedial corner; C, lateral view, left side. Attachments of LE1 and LI1 to SPb1 released.



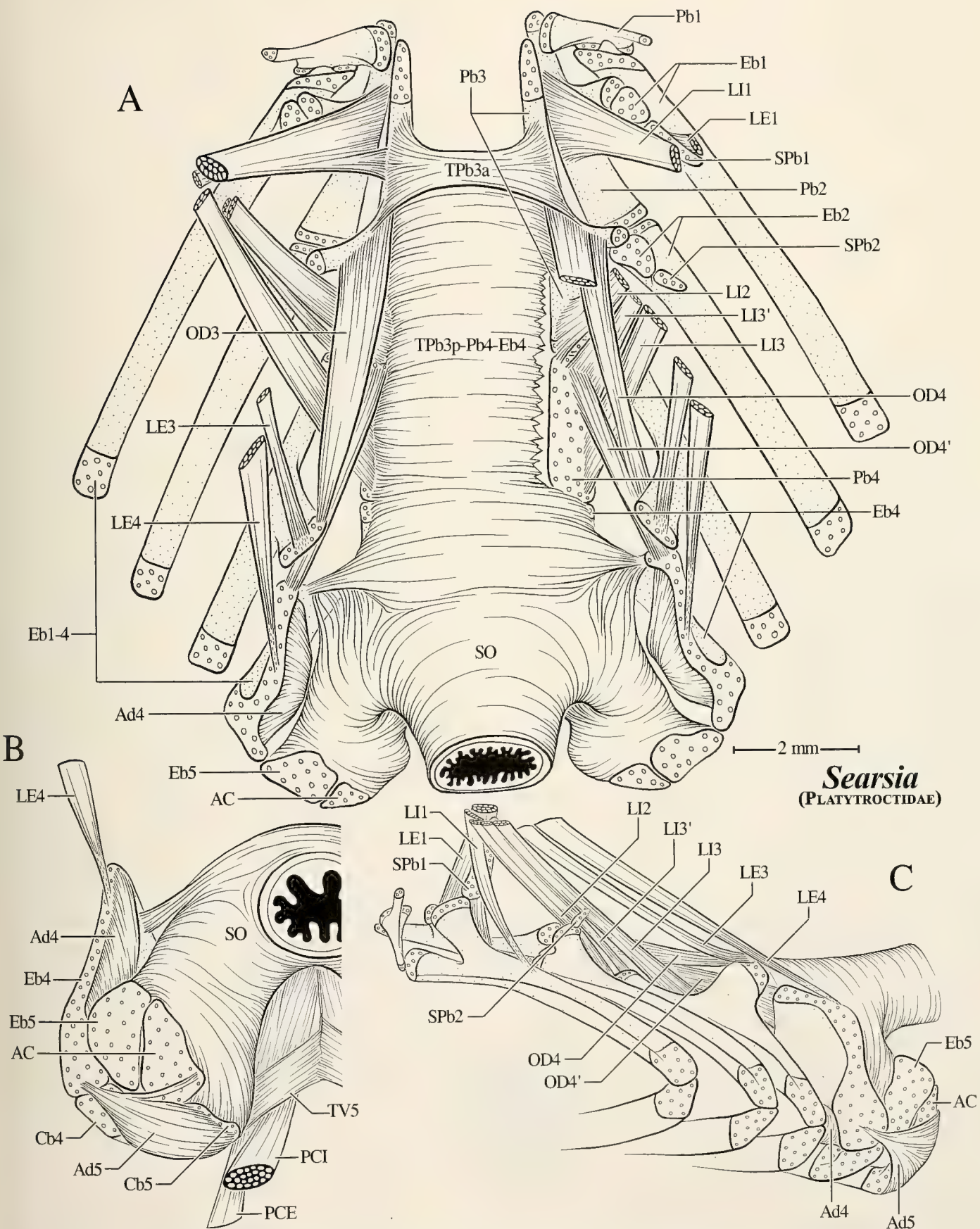


Plate 46. *Searsia koefoedi*, USNM 206873: A, dorsal view, right-side TPb3p-Pb4-Eb4 and OD3 cut away to reveal insertions of LIs; left-side SPb1 and SPb2 occluded from view by surrounding LIs; B, posterior view, right side reversed; C, lateral view, left side.





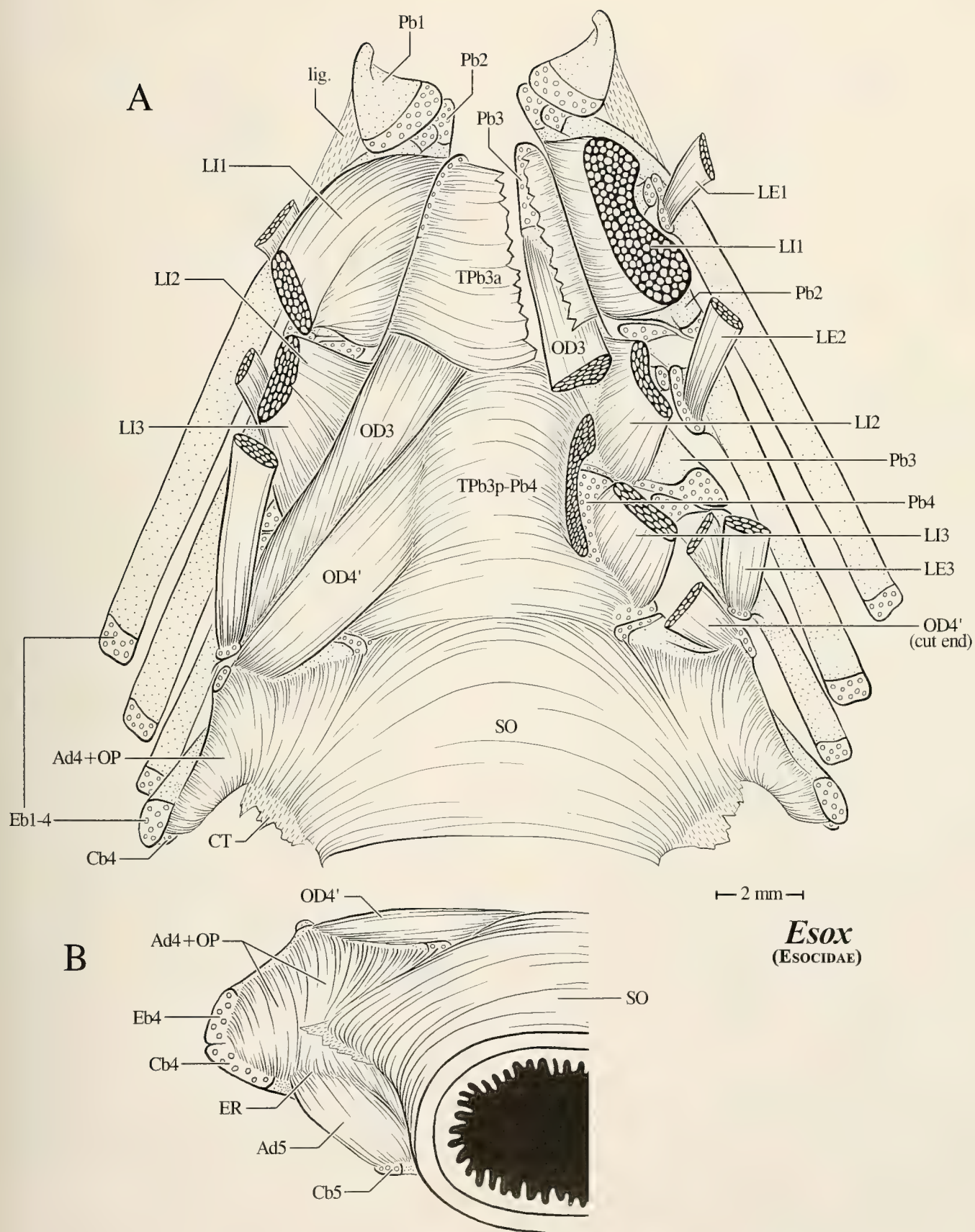
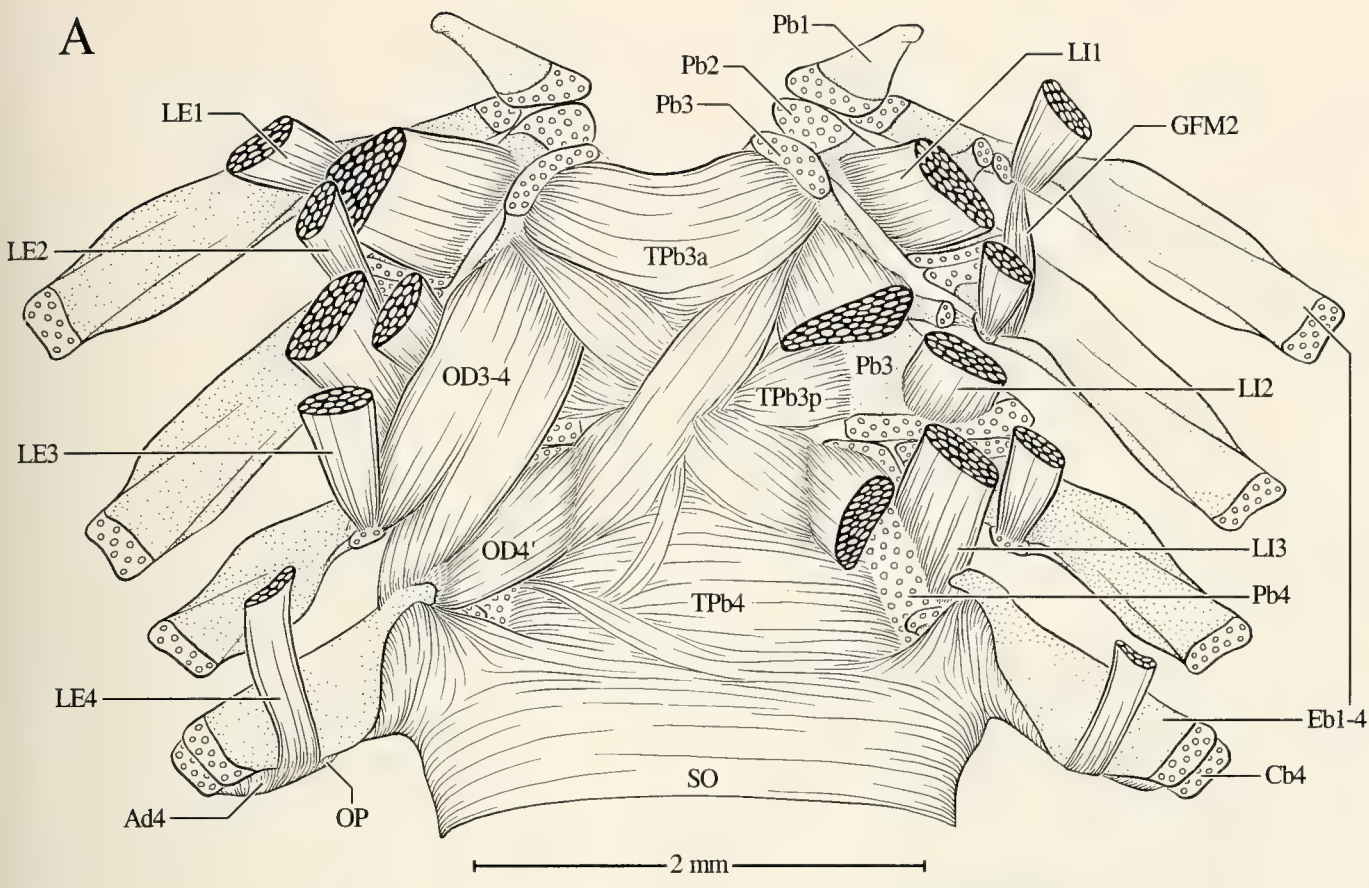


Plate 47. *Esox niger*, USNM 355803: A, dorsal view, right-side TPb3a, OD3, and OD4 cut away to reveal origin of OD3 and insertions of LI2 and LI3 (origins unite dorsally); B, posterior view, left side, Ad4 and OP inseparable.





*Novumbra*  
(UMBRIDAE)

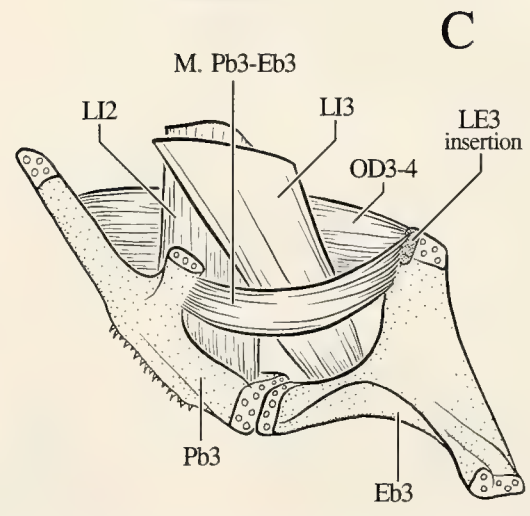
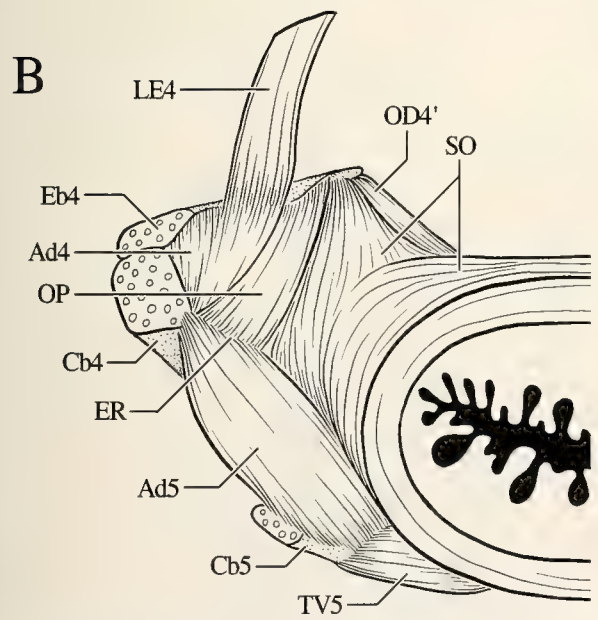


Plate 48. *Novumbra hubbsi*, USNM 357403 (see description): A, larger specimen, dorsal view: right-side OD3-4 and OD4' cut away to reveal TPb3p attachment and LI2 and LI3 insertions; M. Pb3-Eb3 occluded from view; B, C, smaller specimen: B, posterior view, left side; C, lateral view, left-side Pb3 and Eb3 to show attachments of M. Pb3-Eb3.





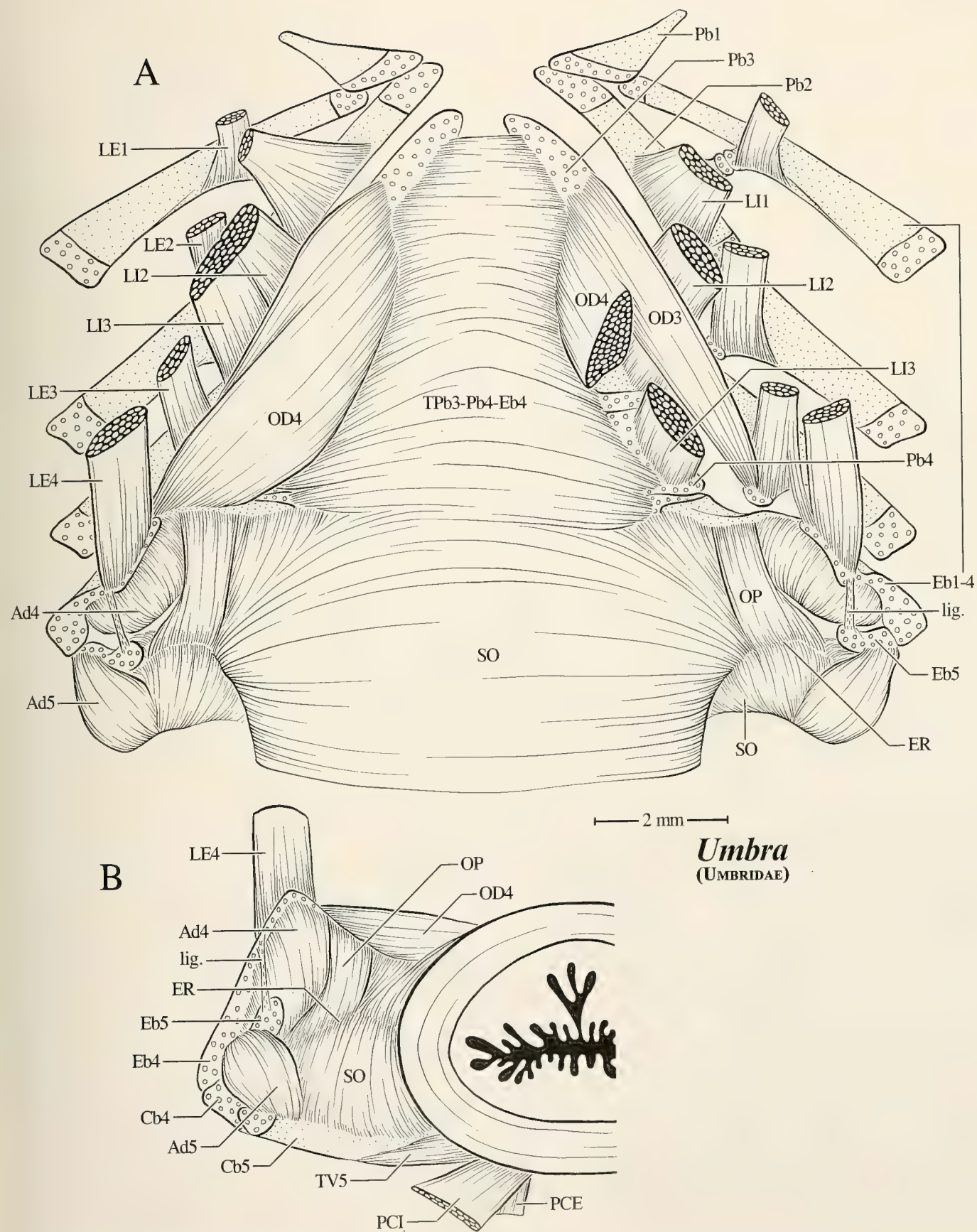


Plate 49. *Umbra pygmaea*, USNM 343617: A, dorsal view, right-side OD4 cut away to reveal LI3 insertion on Pb4; Pb1s forced anteriorly; B, posterior view, left side.



A

# Diplophos

(DIPLOPHIDAE)

2 mm

B

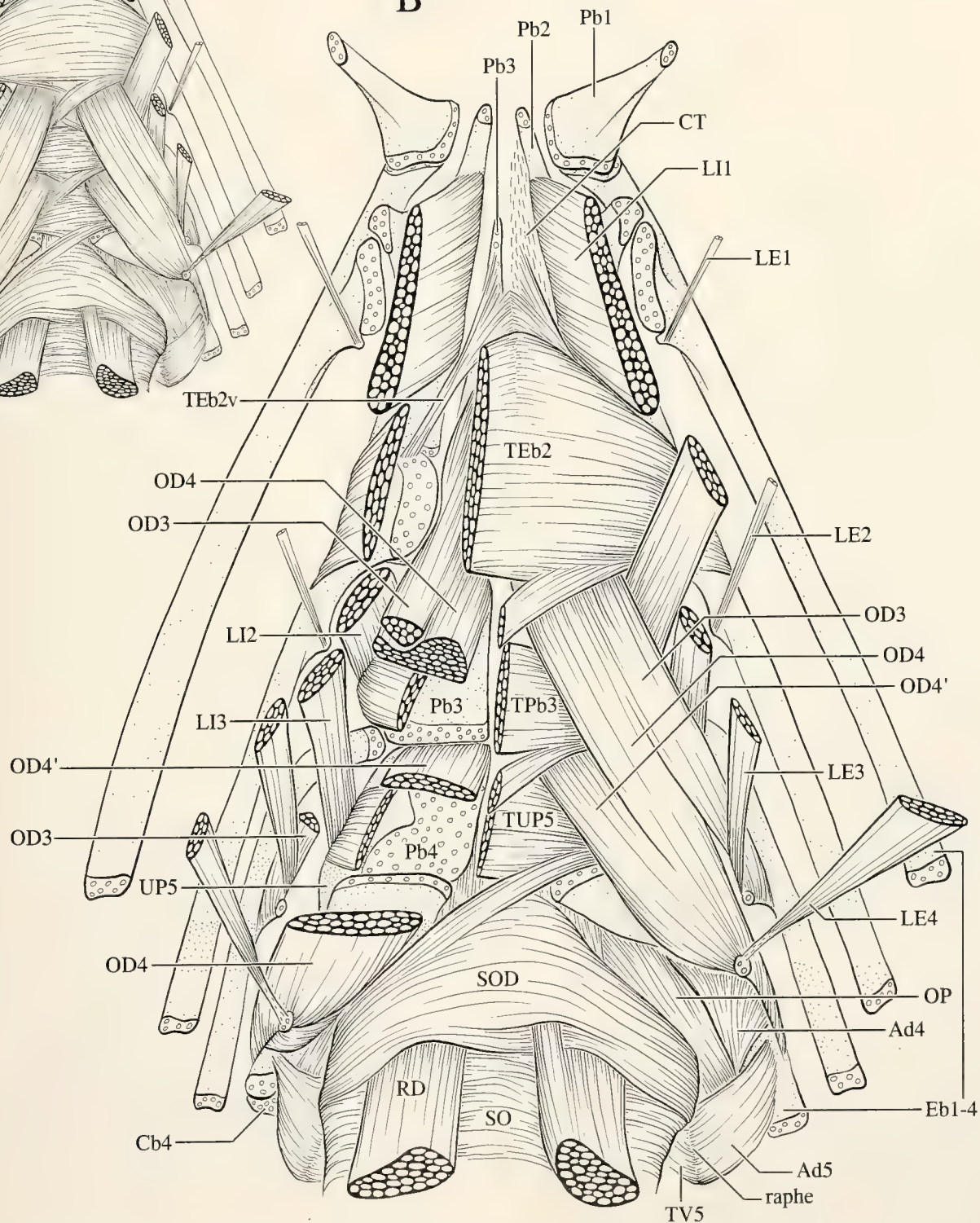
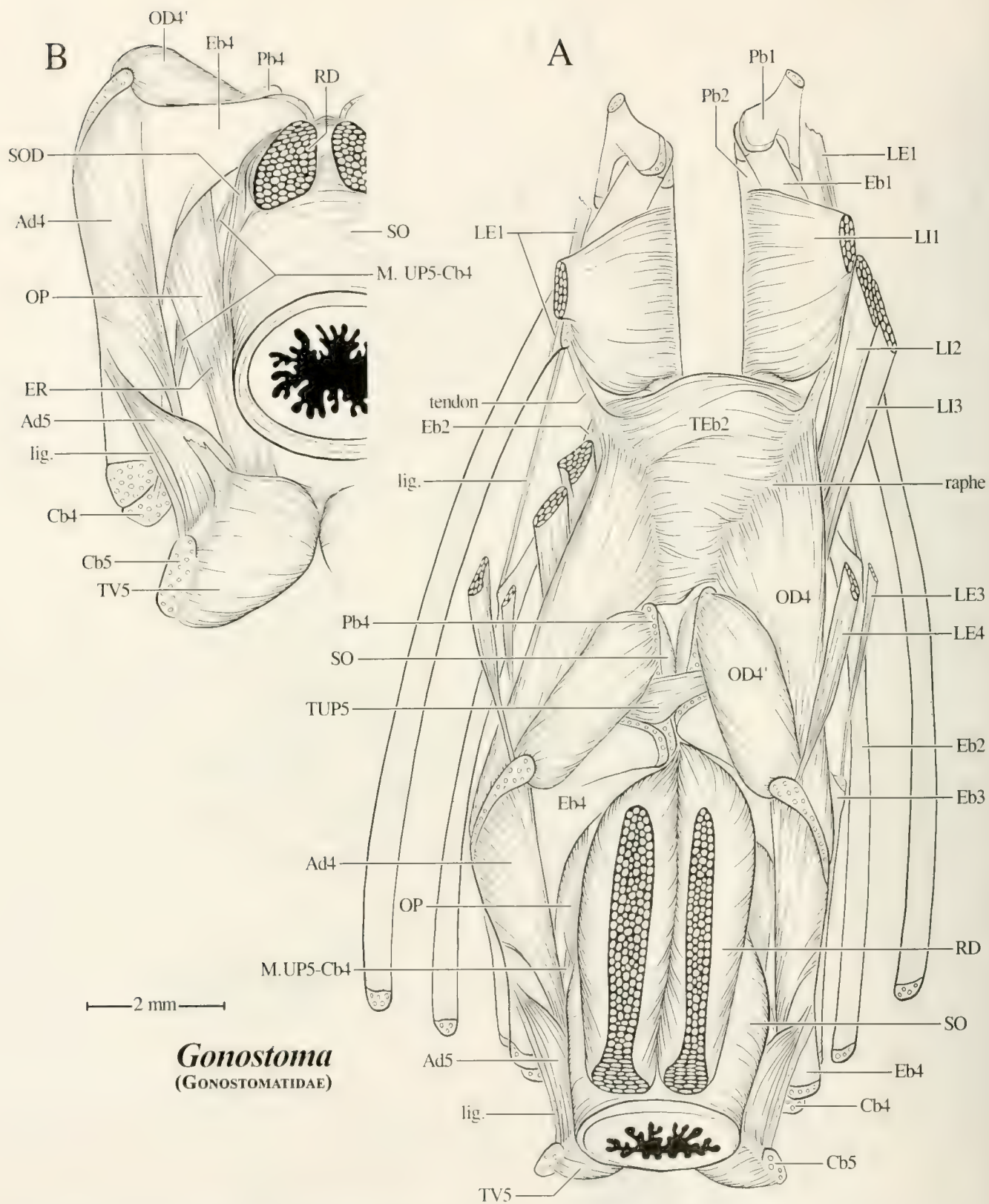


Plate 50. *Diplophos taenia*, USNM 206614: dorsal views, A, complete view; B, view with several muscles cut away to reveal underlying structures and muscle connections (note: asymmetry at posterior end allows AD4 and OP to be visible on right side, but not on left side; RD inserts on medial edge of UP5).



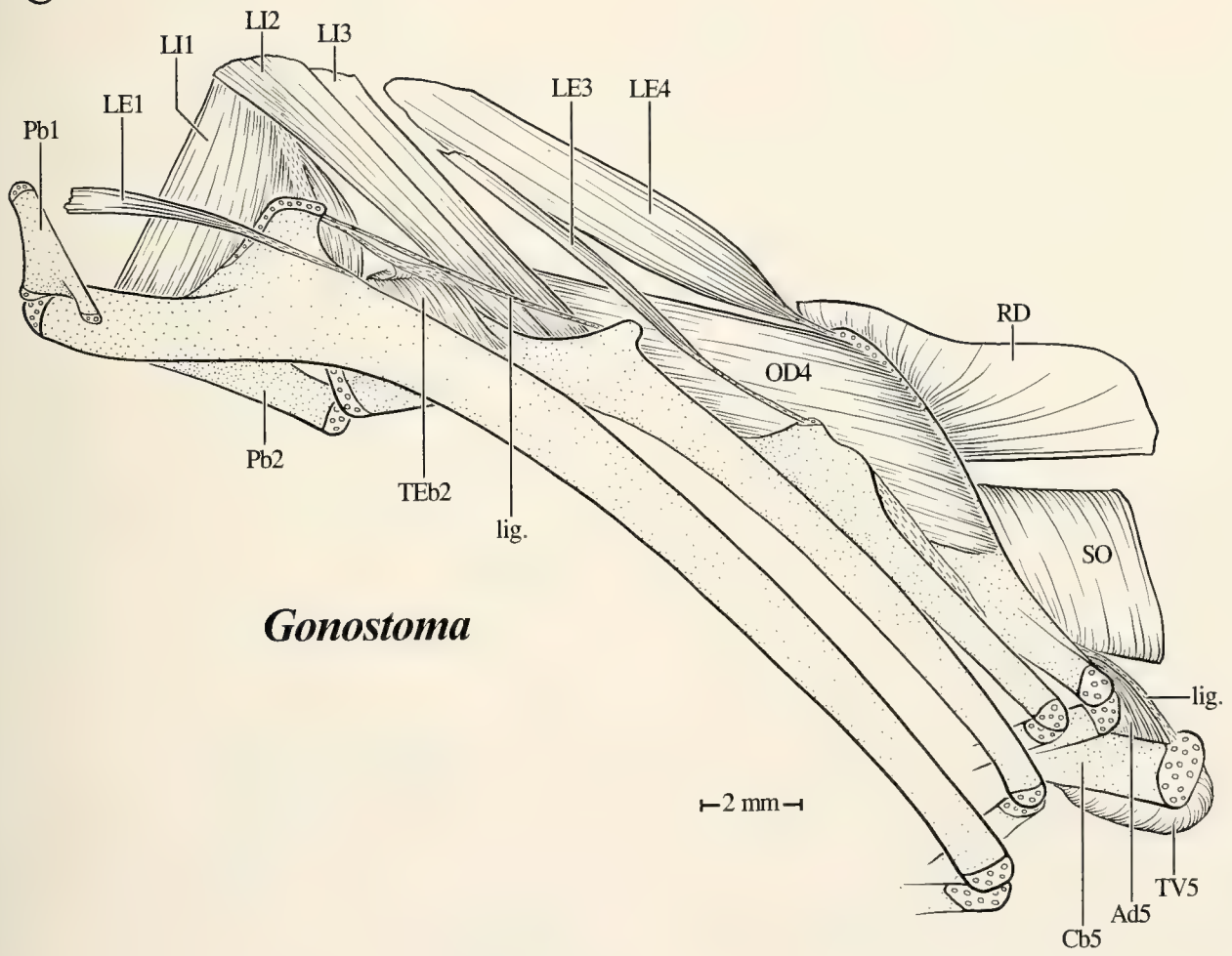






Plates 52.1, 52.2. *Gonostoma elongatum*, USNM 330309: A, dorsal view; B, posterior view, left side, RDs removed nearly to their insertions and bones spread to clarify muscle attachments; LE4 removed; C, lateral view, right side reversed.

C







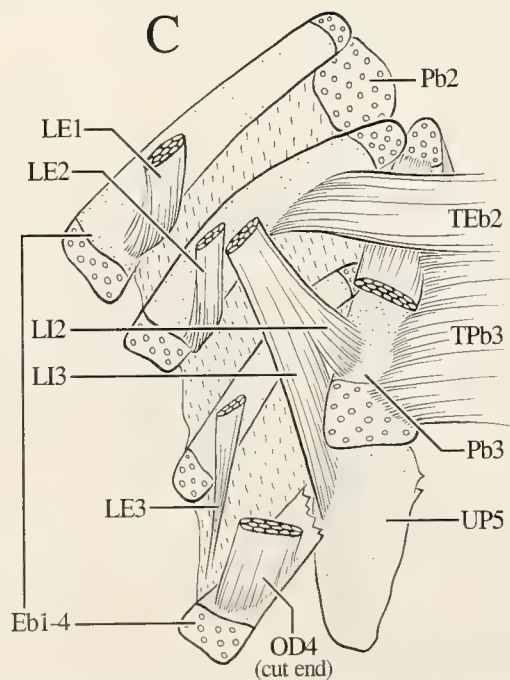
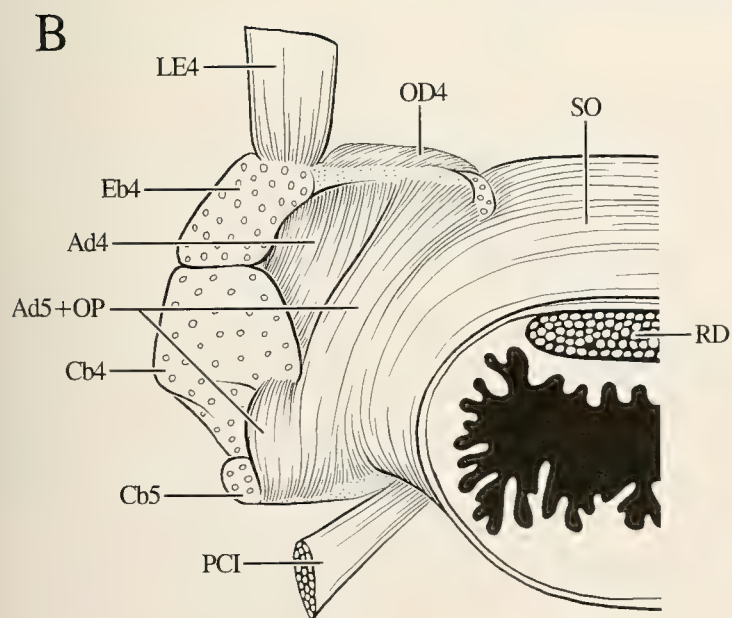
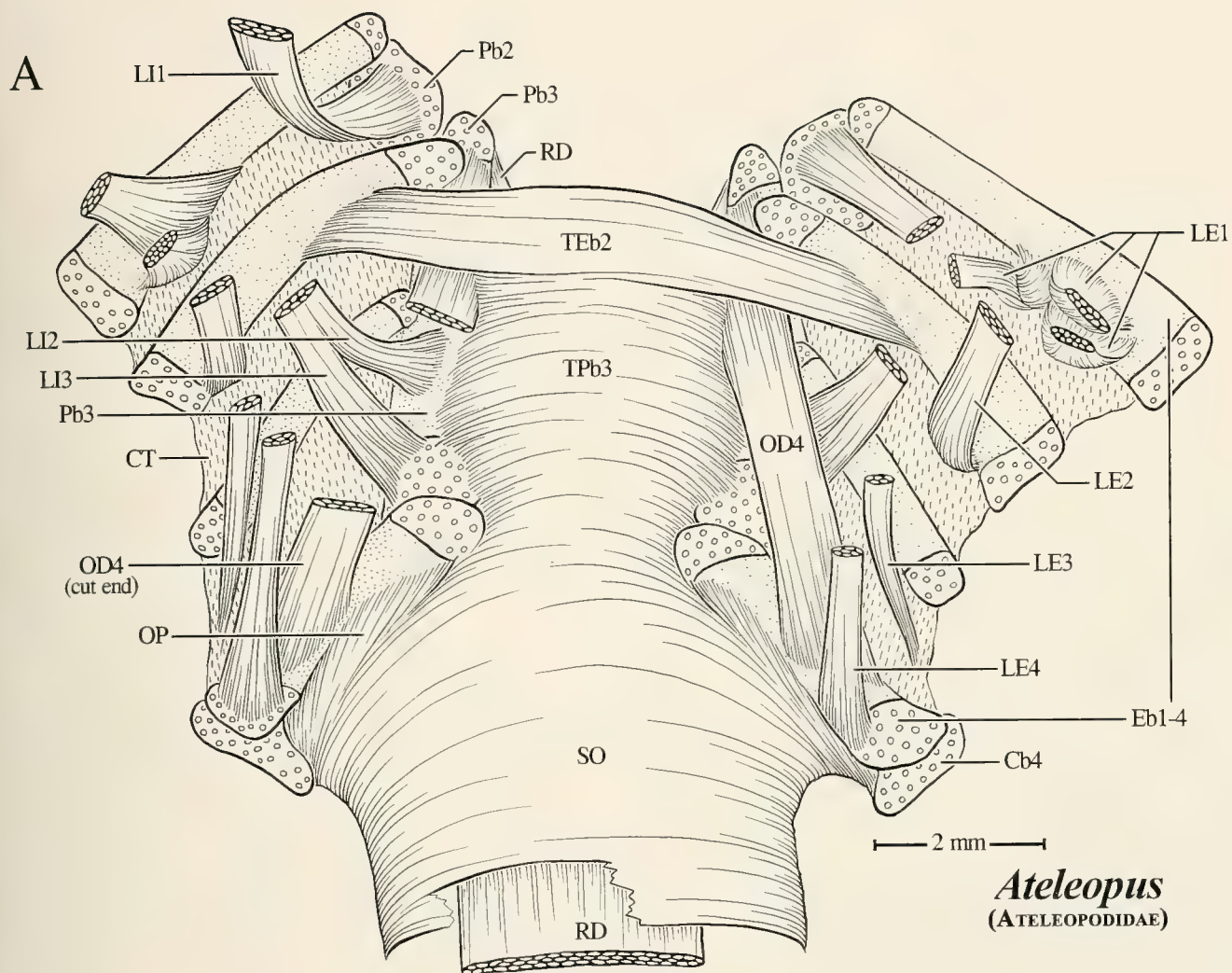
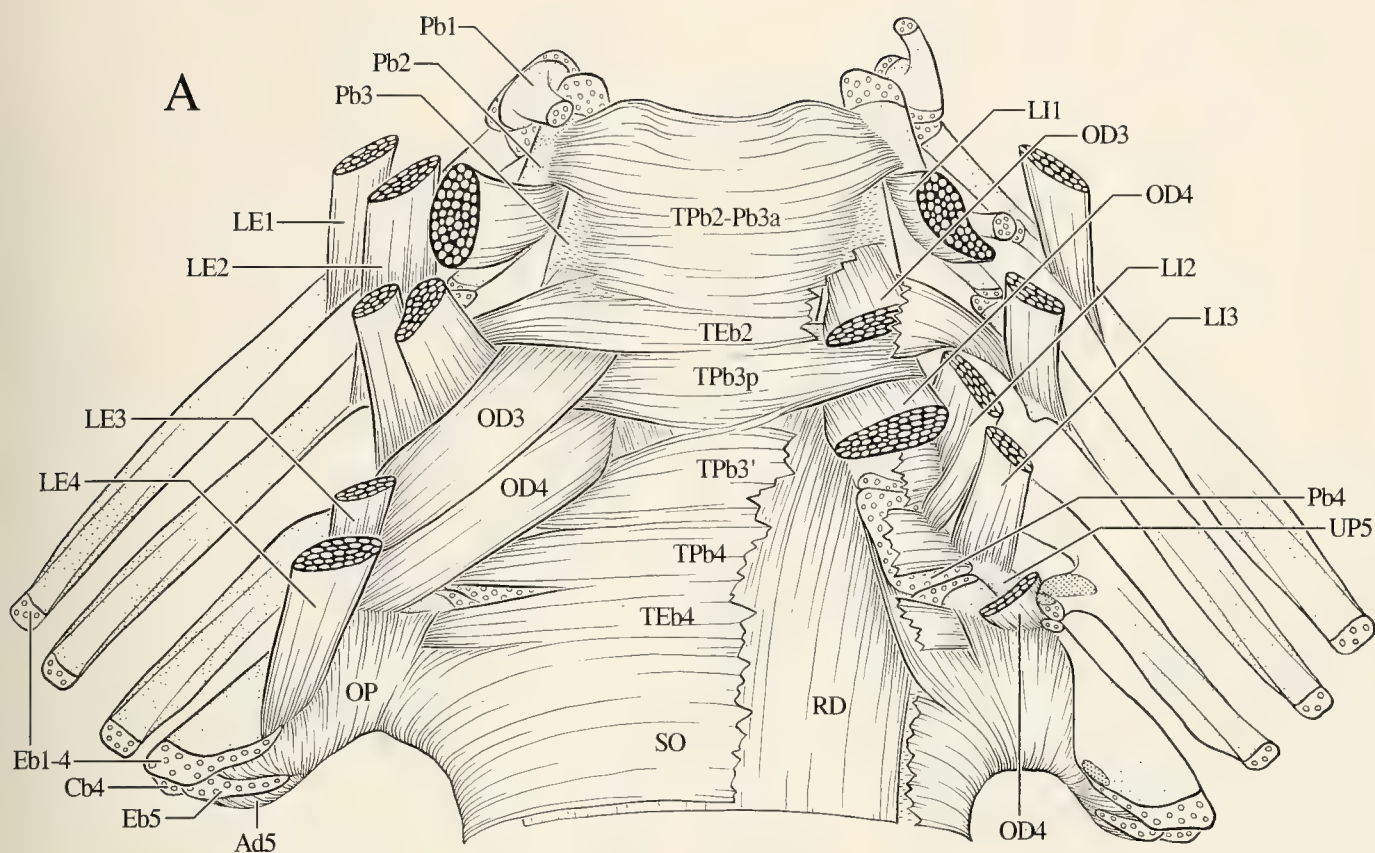


Plate 53. A, B, *Ateleopus loppei*, USNM 349721: A, dorsal view, left-side OD4 cut away to reveal insertions of LI2 and LI3; B, posterior view, left side; C, Ateleopodidae, USNM 361124: dorsal view, left-side dorsal gill arches with most muscles removed or cut away to reveal insertions of LI2 and LI3.





— 2 mm —

*Aulopus*  
(AULOPIDAE)

**B**

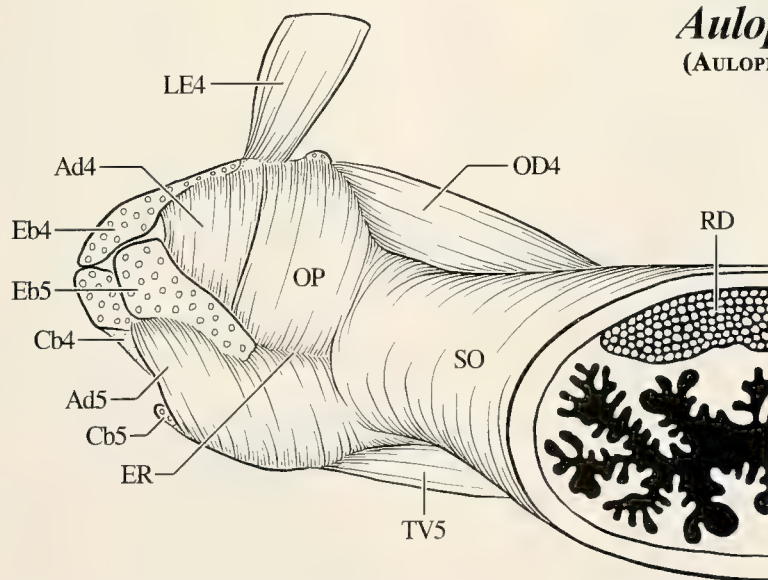


Plate 54. *Aulopus filamentosus*, USNM 313689: A, dorsal view, right-side TEb2, TPb3', TPb4, TEb4 cut away to reveal underlying RD; right-side OD3 and OD4 cut away to reveal insertions of LI2 and LI3 (OD3 insertion site indicated by shaded area); right-side LE3 and LE4 removed (insertions indicated by shaded areas); right-side Pb1 rotated anteriorly; B, posterior view, left side.





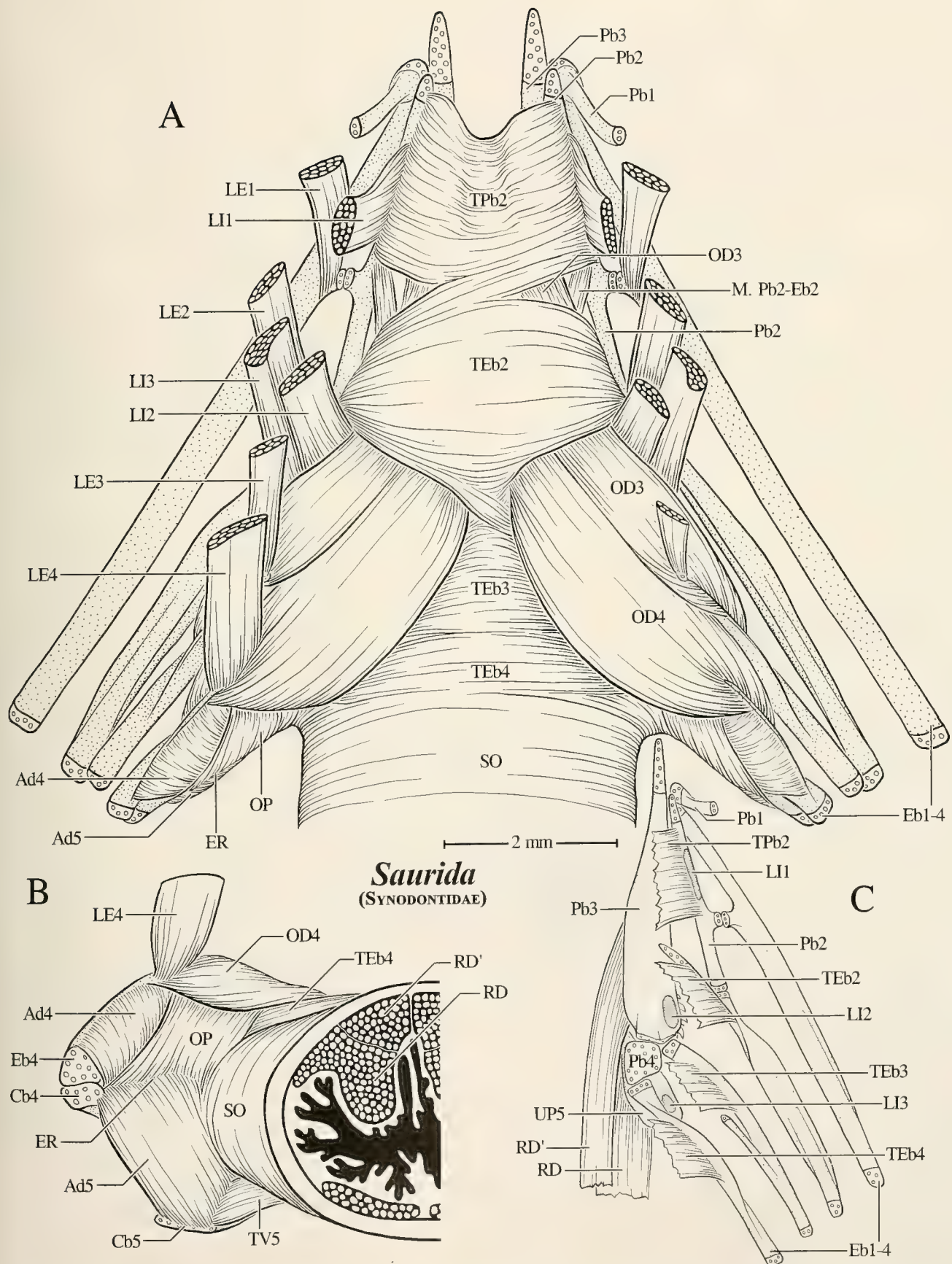
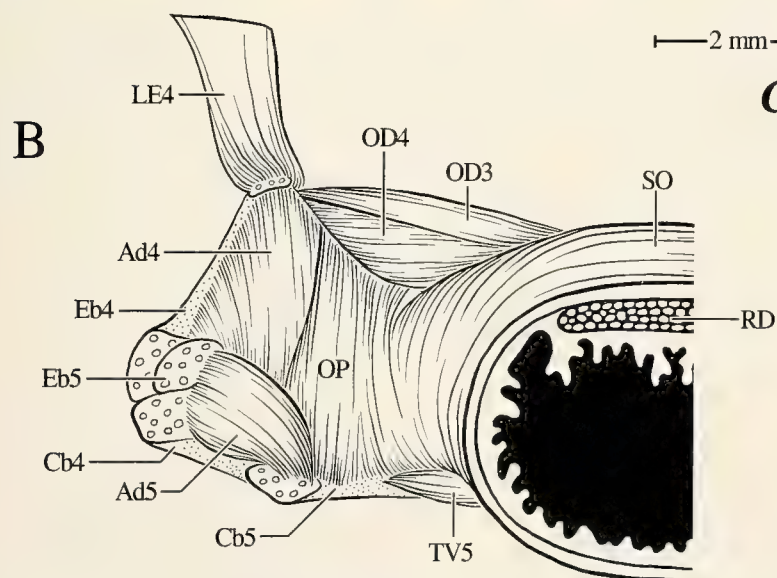
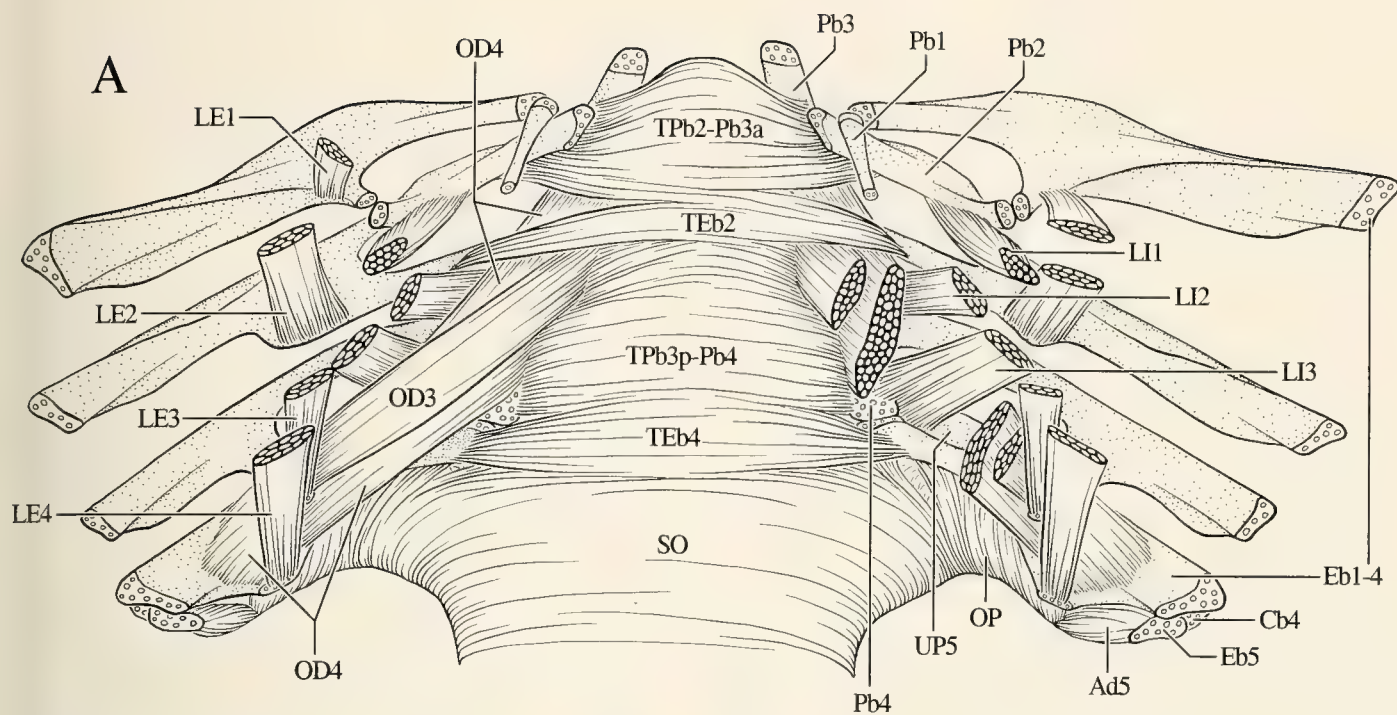


Plate 55. *Saurida gracilis*, USNM 140822: A, dorsal view, right-side LE4 removed; B, posterior view, right side reversed; C, right-side dorsal gill arches, insertions of LI1-LI3 indicated on Pb2, Pb3, and UP5, respectively; transverse dorsalis muscles cut away except near their attachments on Pb2, Eb2, Eb3, and Eb4.





*Chlorophthalmus*  
(CHLOROPHTHALMIDAE)

Plate 56. *Chlorophthalmus agassiz*, A, USNM 357798: dorsal view, right-side OD3 and OD4 cut away; B, USNM 159379, posterior view, left side.





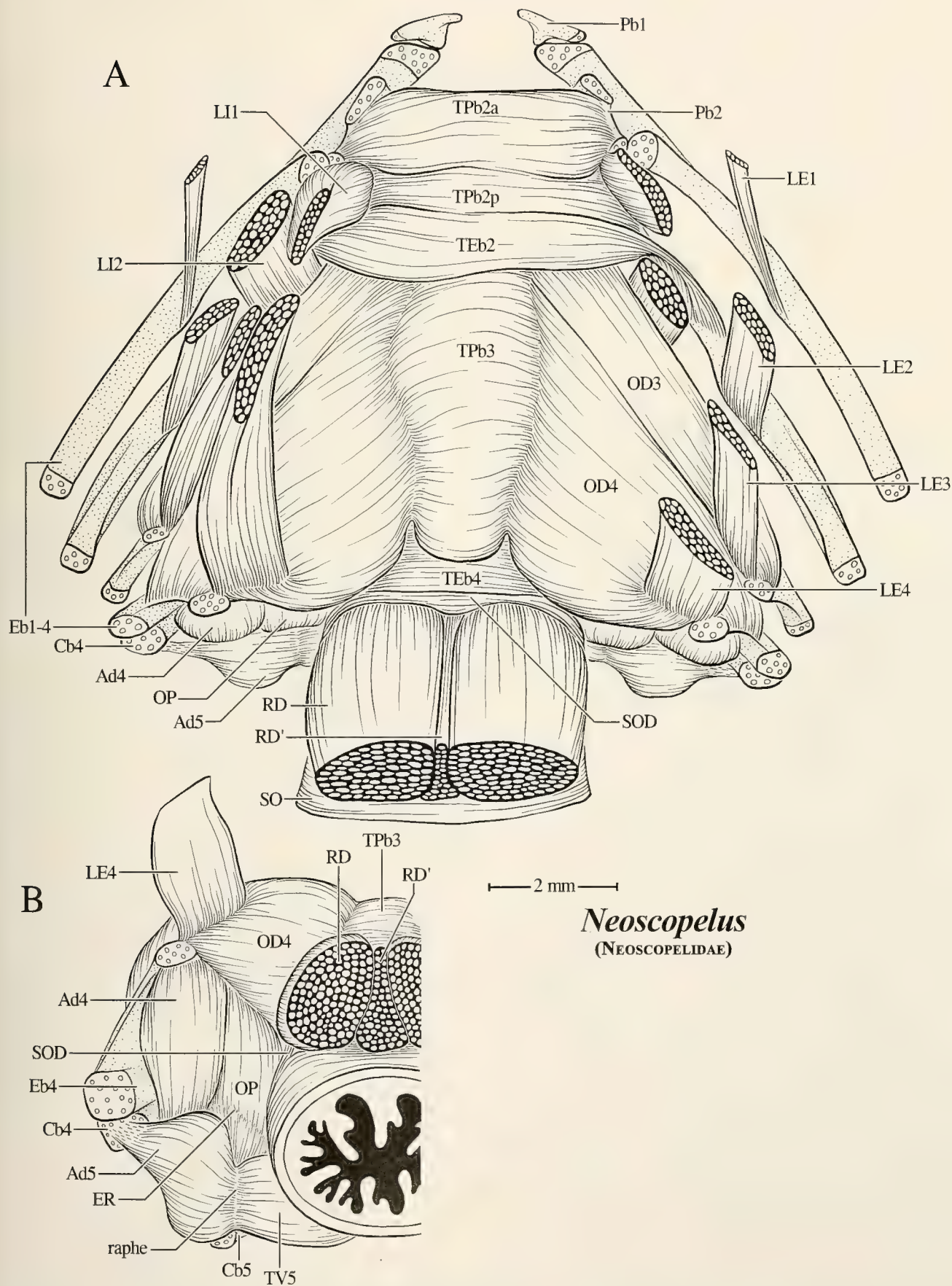


Plate 57. *Neoscopelus macrolepidotus*, USNM 358034: A, dorsal view; B, posterior view, left side.



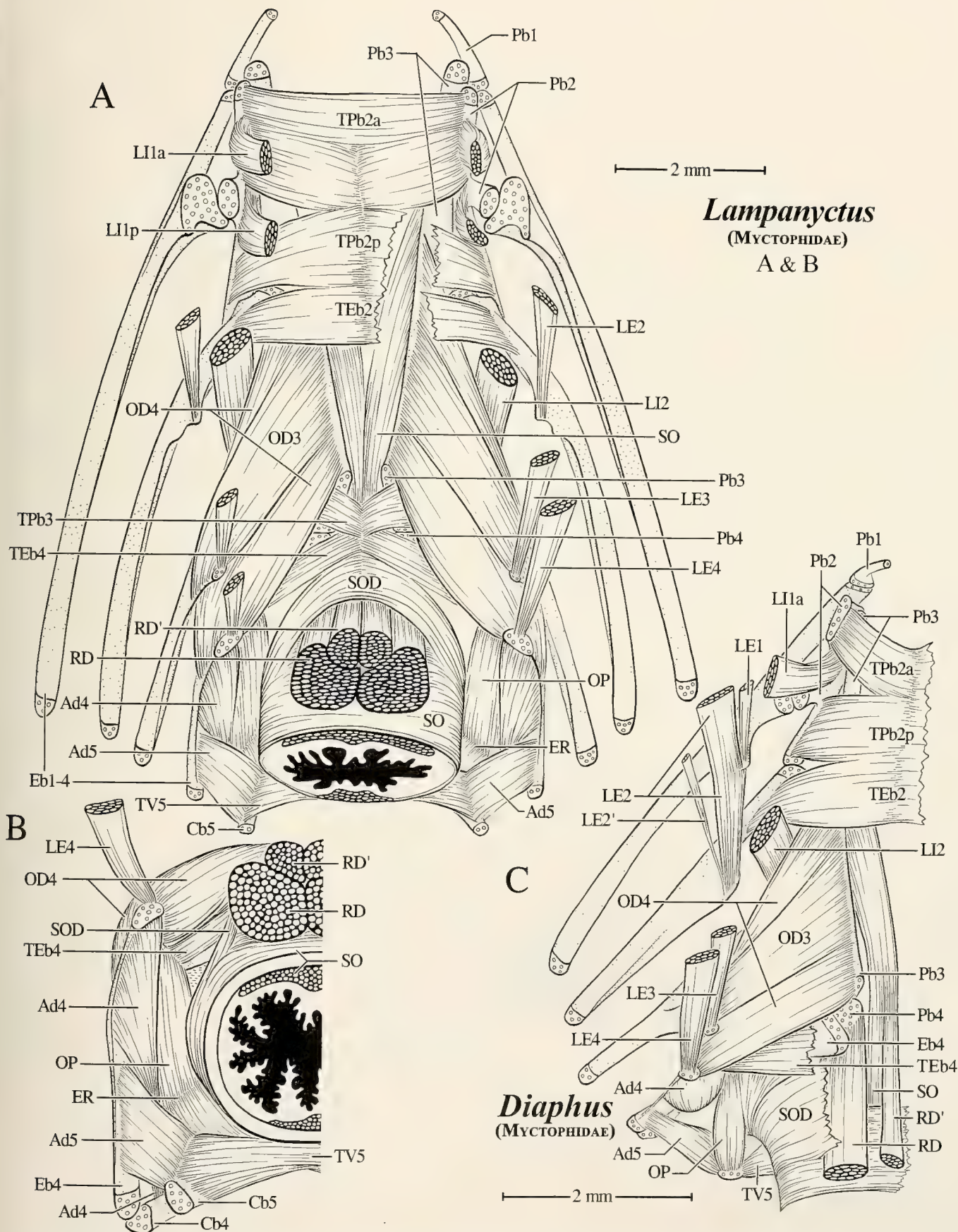


Plate 58. A, B, *Lampanyctus macdonaldi*, USNM 303167: A, dorsal view, right-side TPb2p and TEb2 cut away to reveal attachment of SO longitudinal muscle insertion on Pb3; B, posterior view, right side reversed. C, *Diaphus mollis*, USNM 300877: dorsal view, left-side, TPb3 removed and RD' and longitudinal SO muscle fibers deflected medially to reveal connections of RD and RD'.





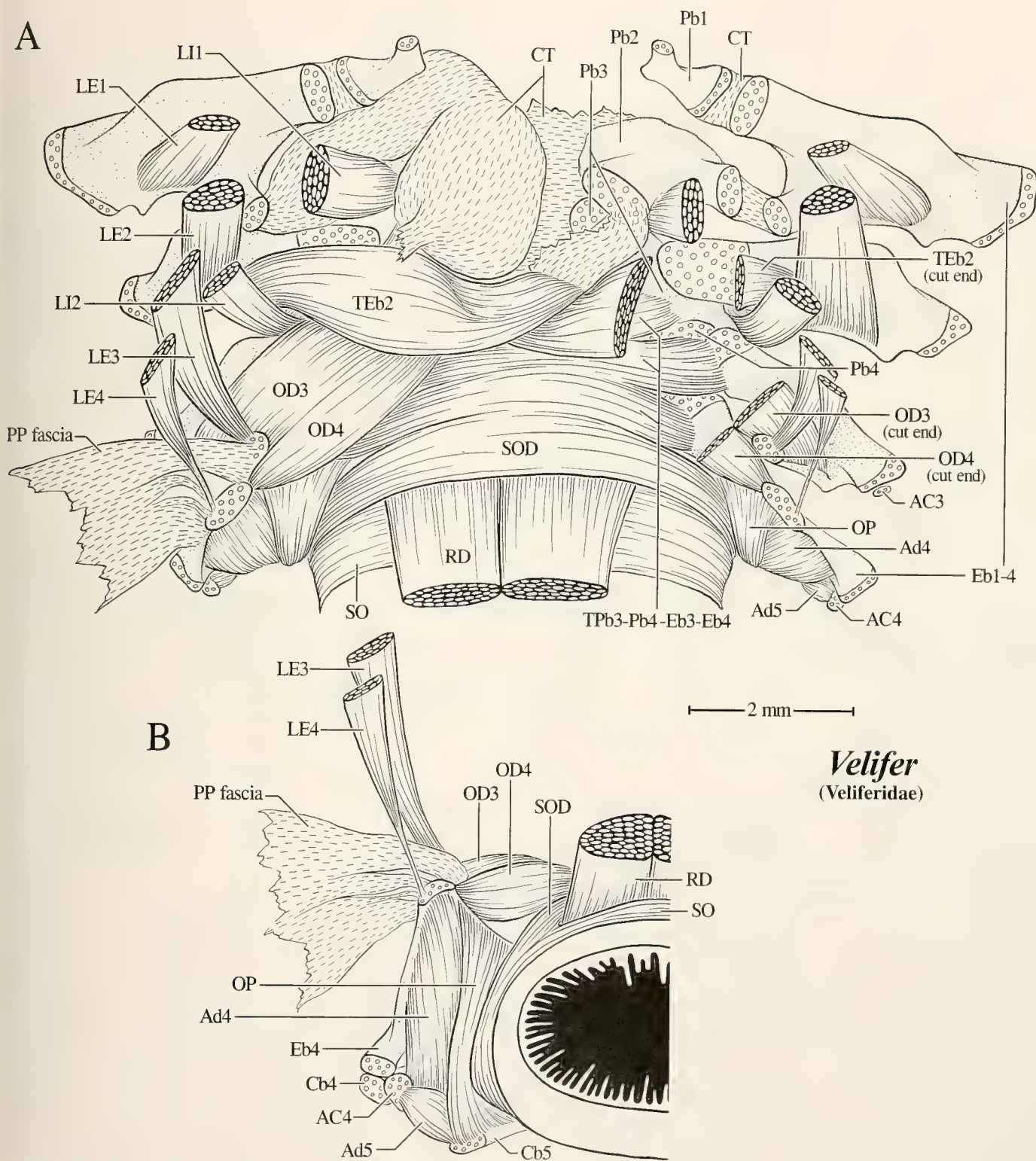
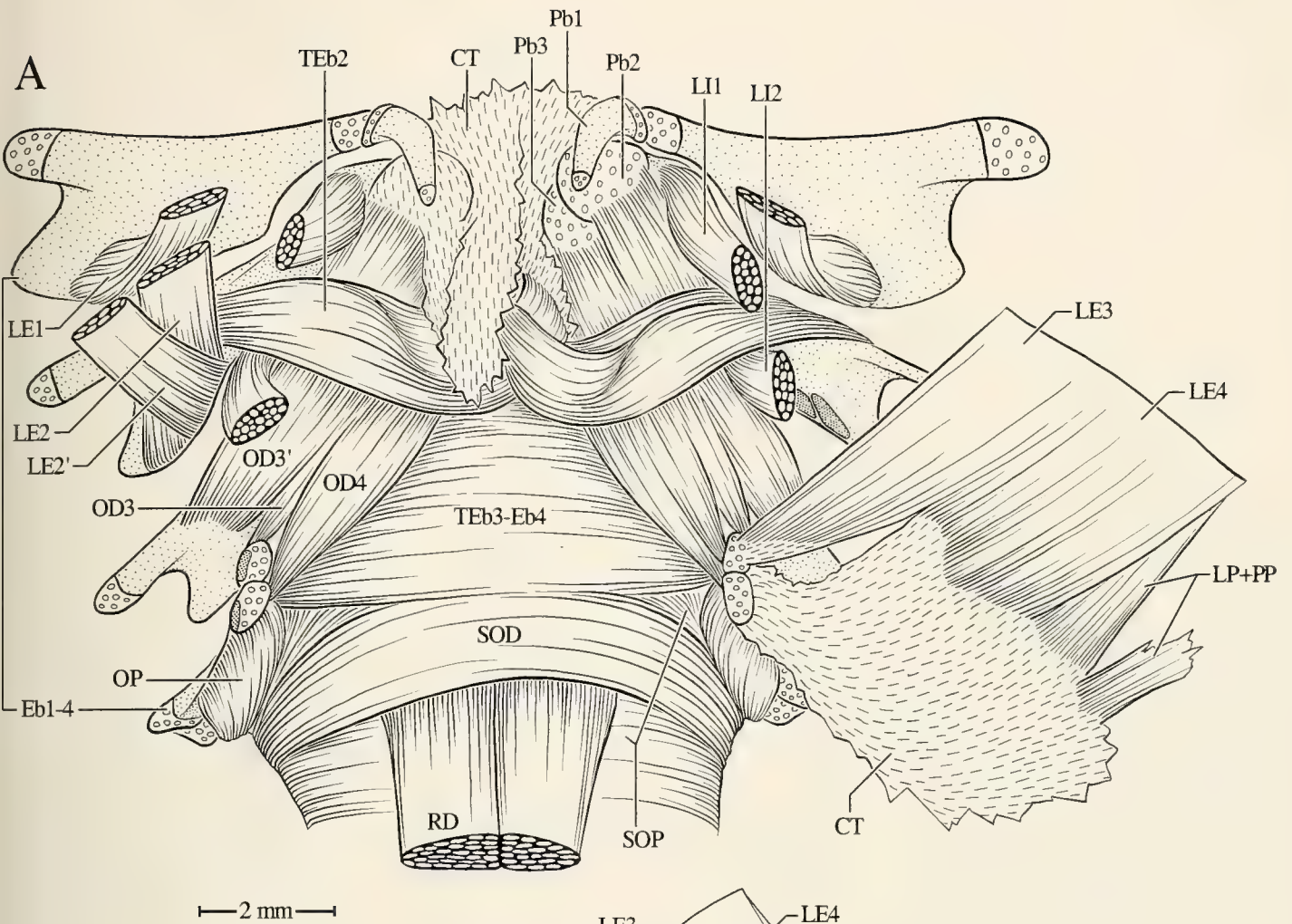


Plate 59. *Velifer* sp., NSMT-P-59516: A, dorsal view; right-side dorsal CT pad removed, TEb2 cut away, OD3–4 bisected, and PP fascia removed. B, posterior view, left side.





***Lampris***  
(Lampridae)

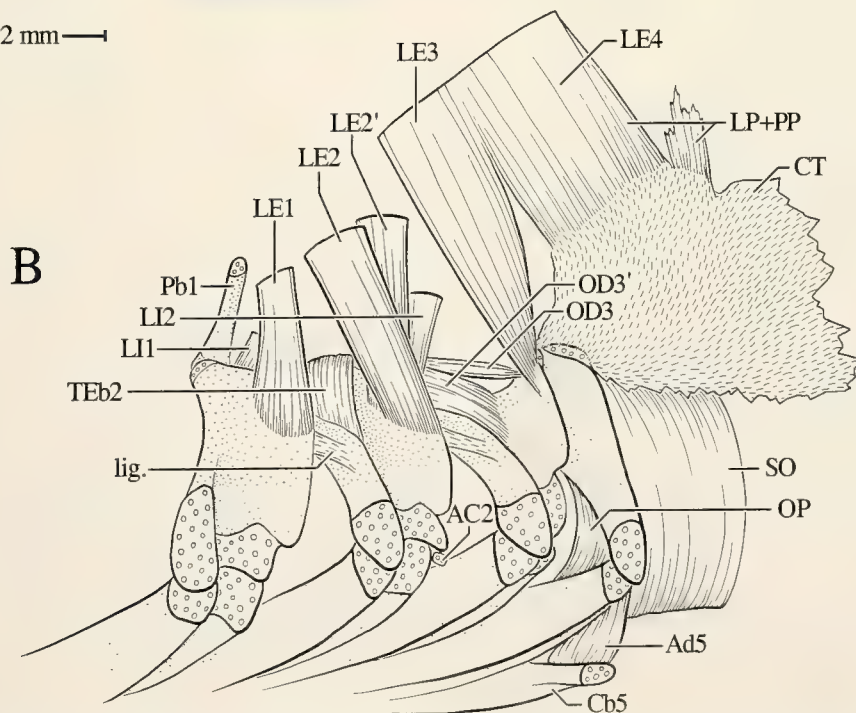


Plate 60. *Lampris guttatus*, SIO 80-72: A, dorsal view, left-side LE3-LE4-LP complex removed, right-side LE2 removed and illustrated in place of left side LE2 (see remarks following LE2 in *Lampris* description). B, lateral view, right side reversed.





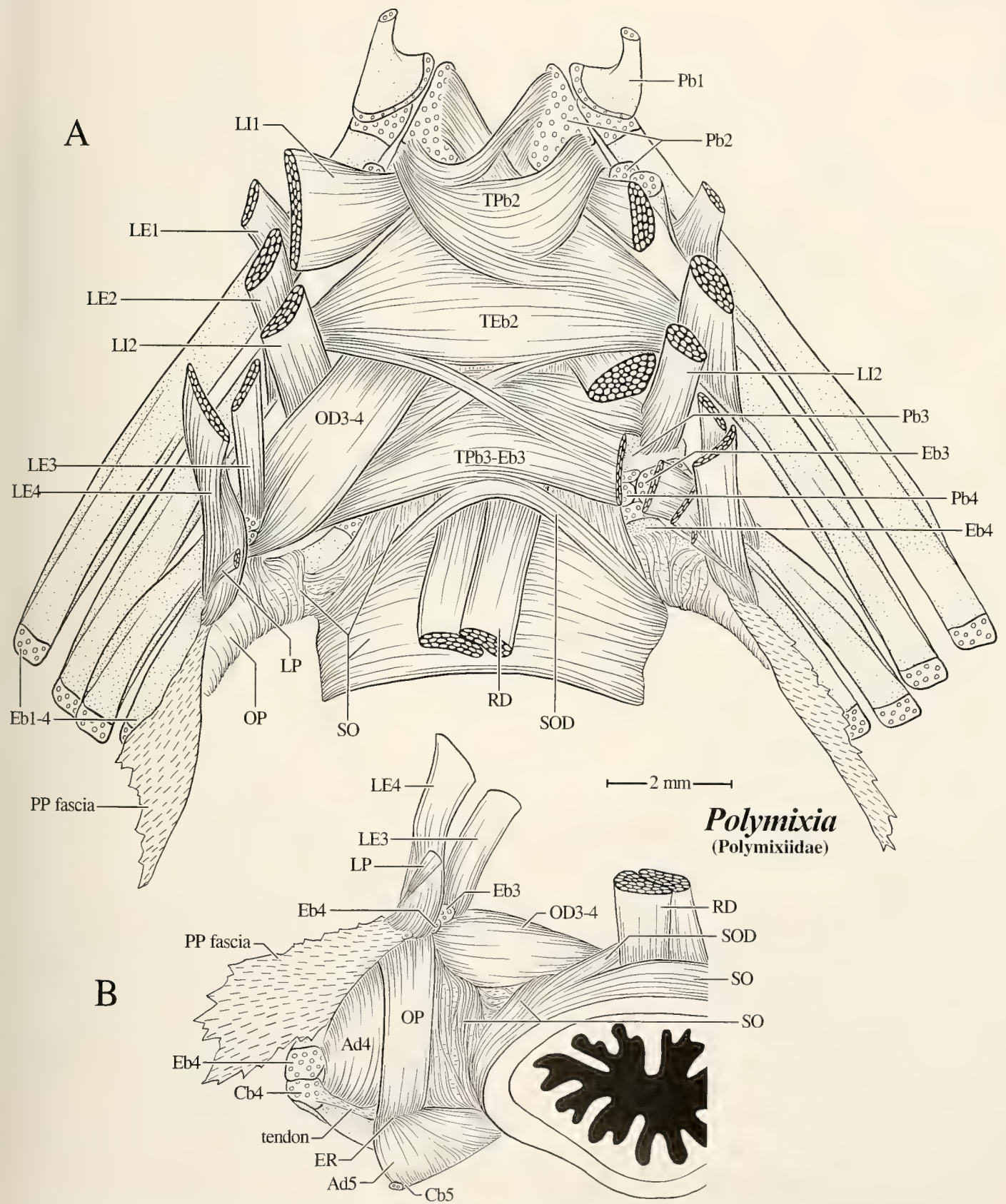
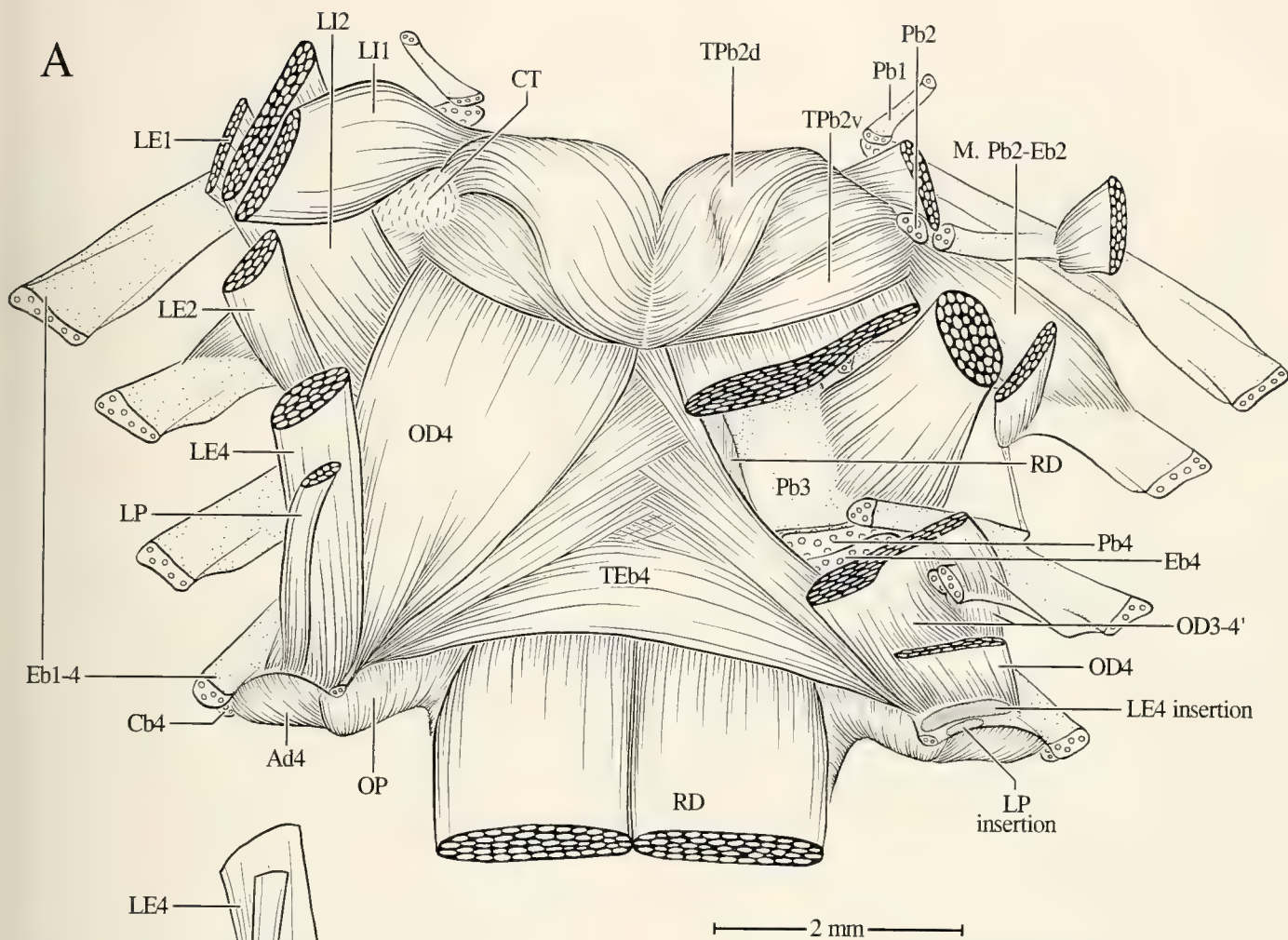
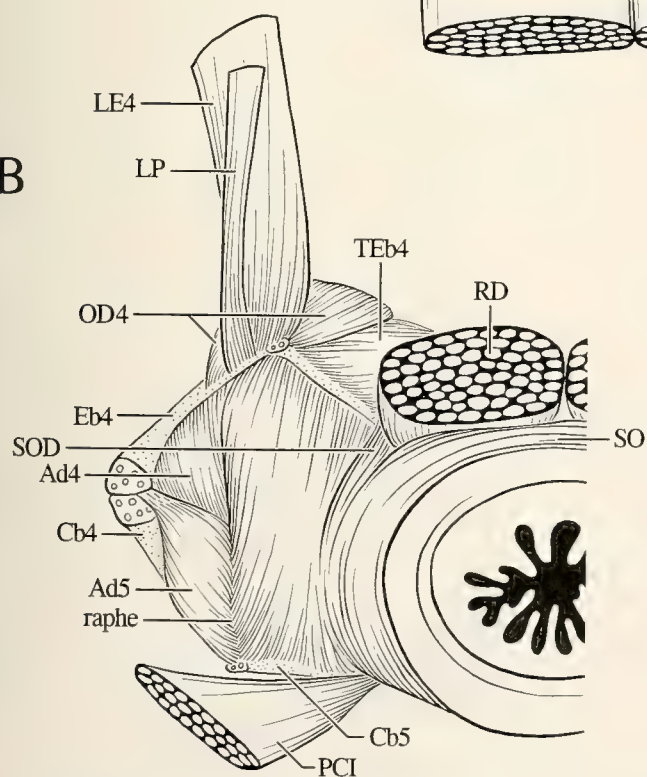


Plate 61. *Polymixia lowei*, USNM 202153: A, dorsal view; right-side OD3-4 and TPb3-Eb3 cut away; M. SO-Pb3 indicated only by anteriormost extending line of SO label. B, posterior view, left side (note small levator process at junction of PP fascia with LE4 insertion; Eb4 label indicates uncinat process).





**B**



*Aphredoderus*  
(Aphredoderidae)

**C**

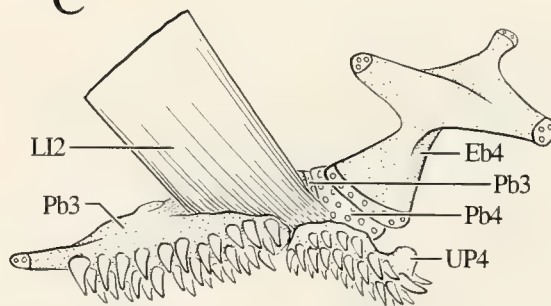
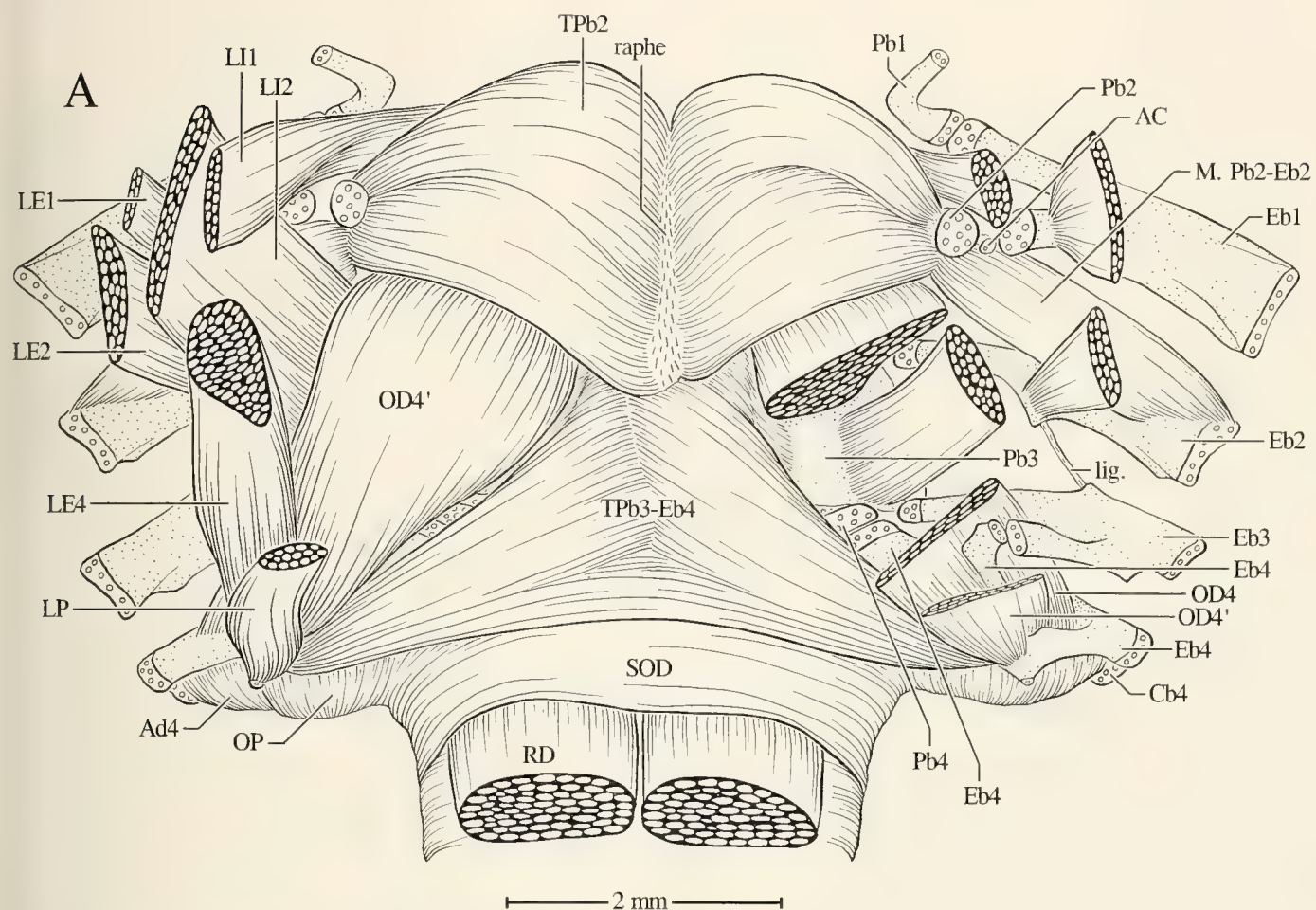


Plate 62. *Aphredoderus sayanus*, USNM 238477: A, dorsal view, right-side OD3-4 cut away and LE4, LP, and padlike CT encasing Pb2 and Eb1 uncinat processes (cartilage) removed, OD obscured from view. B, posterior view, left side. C, lateral view of LI2 showing insertion on Pb3, Pb4, and UP4, right side reversed.







*Percopsis*  
(Percopsidae)

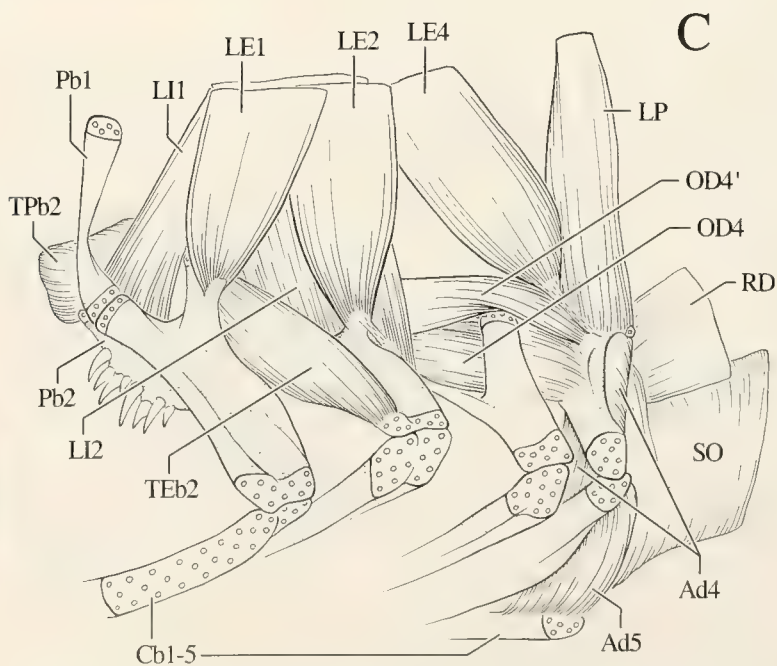
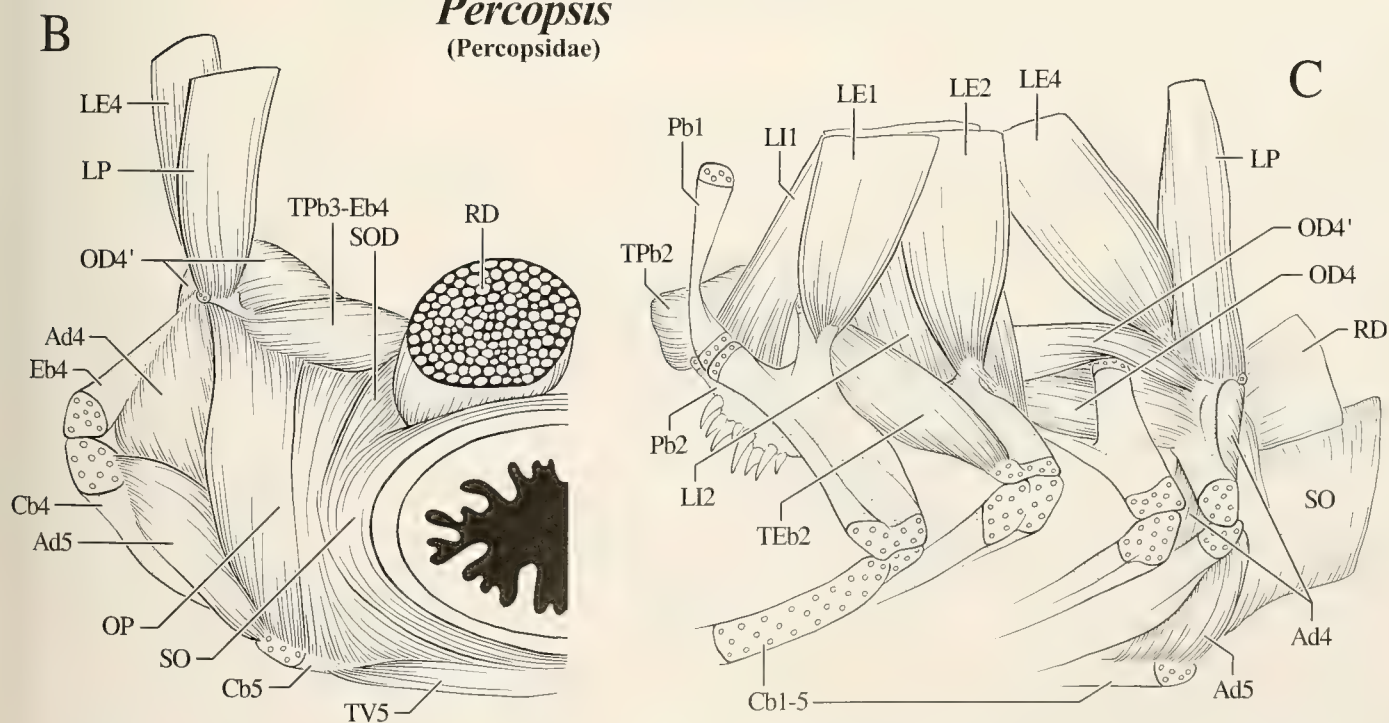


Plate 63. *Percopsis omiscomaycus*, USNM 179711: A, dorsal view, CT attaching to raphe at TPb2 mid-line not shown, right-side OD4 bisected and LE4 and LP removed. B, posterior view, left side. C, lateral view, left side.



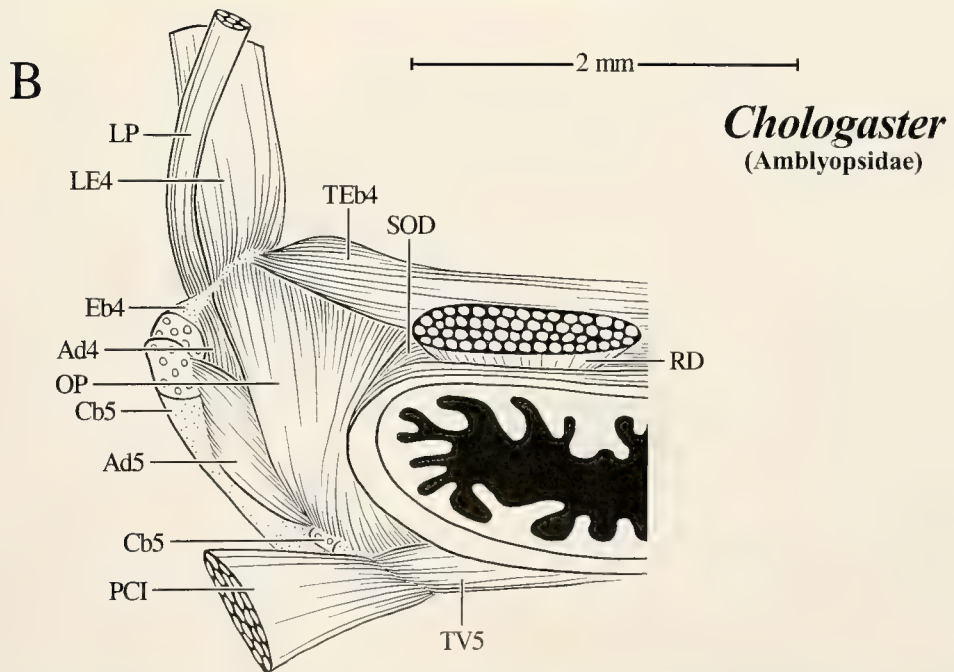
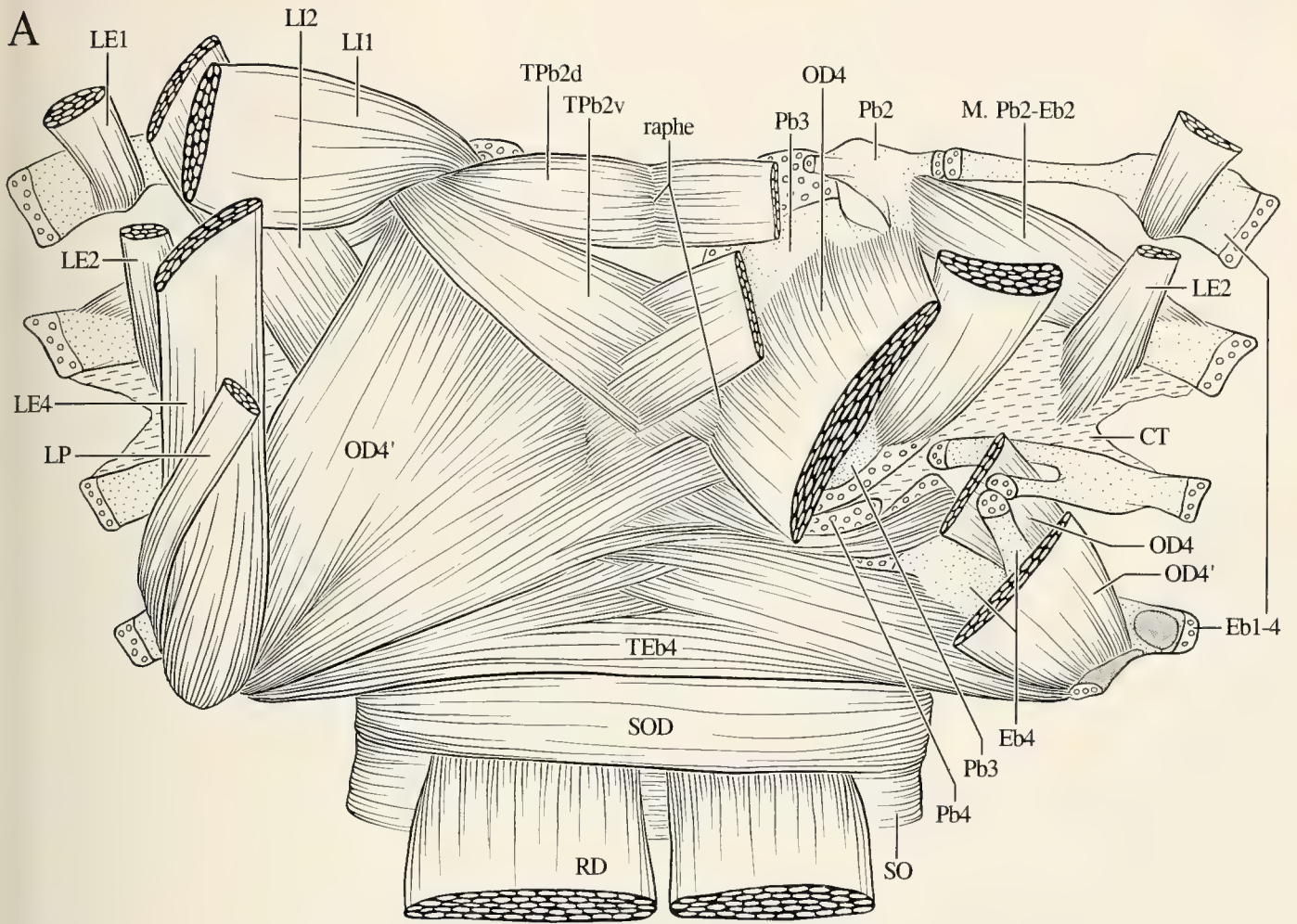
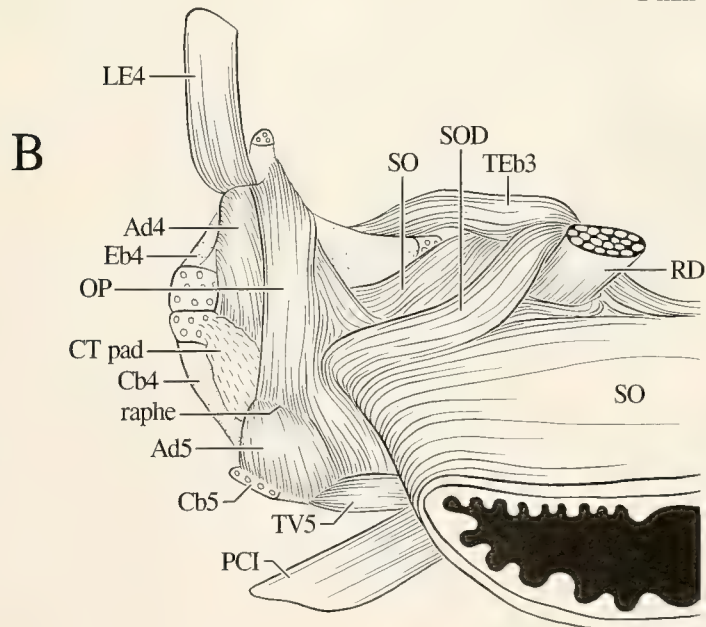
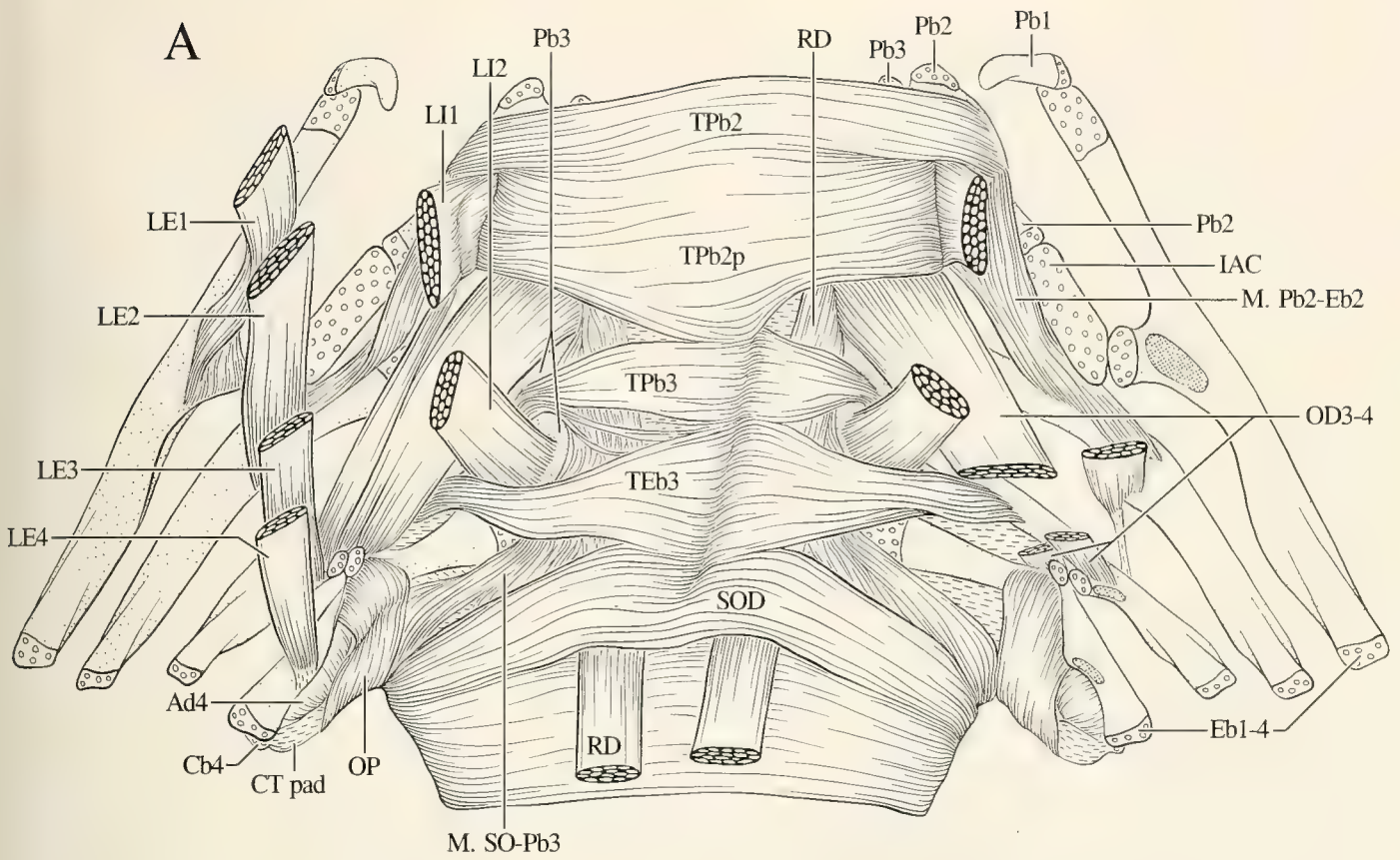


Plate 64. *Chologaster agassizi*, USNM 232514: A, dorsal view, right-side TPb2a, TPb2p, and OD4 cut away and LI1, LE4, and LP removed. B, posterior view, left side.



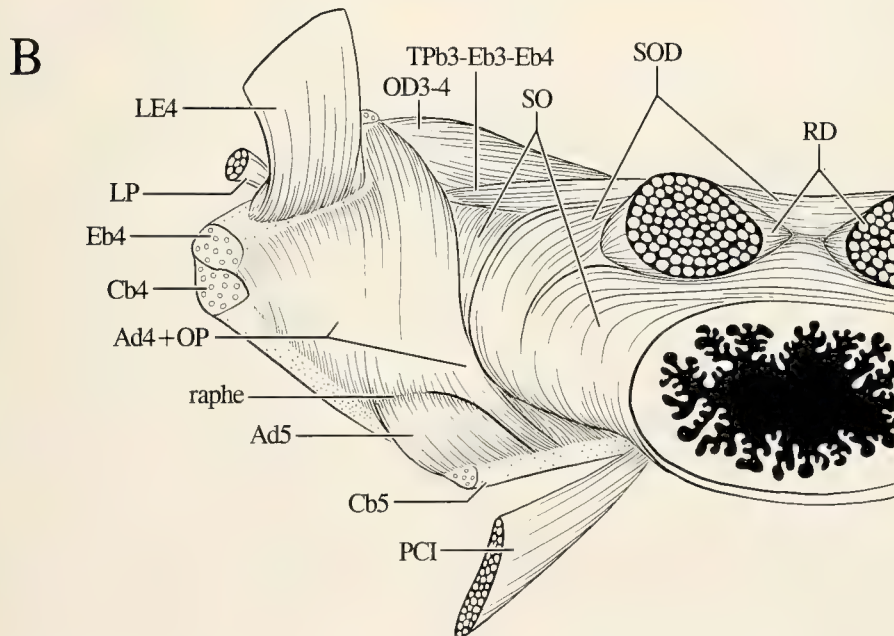
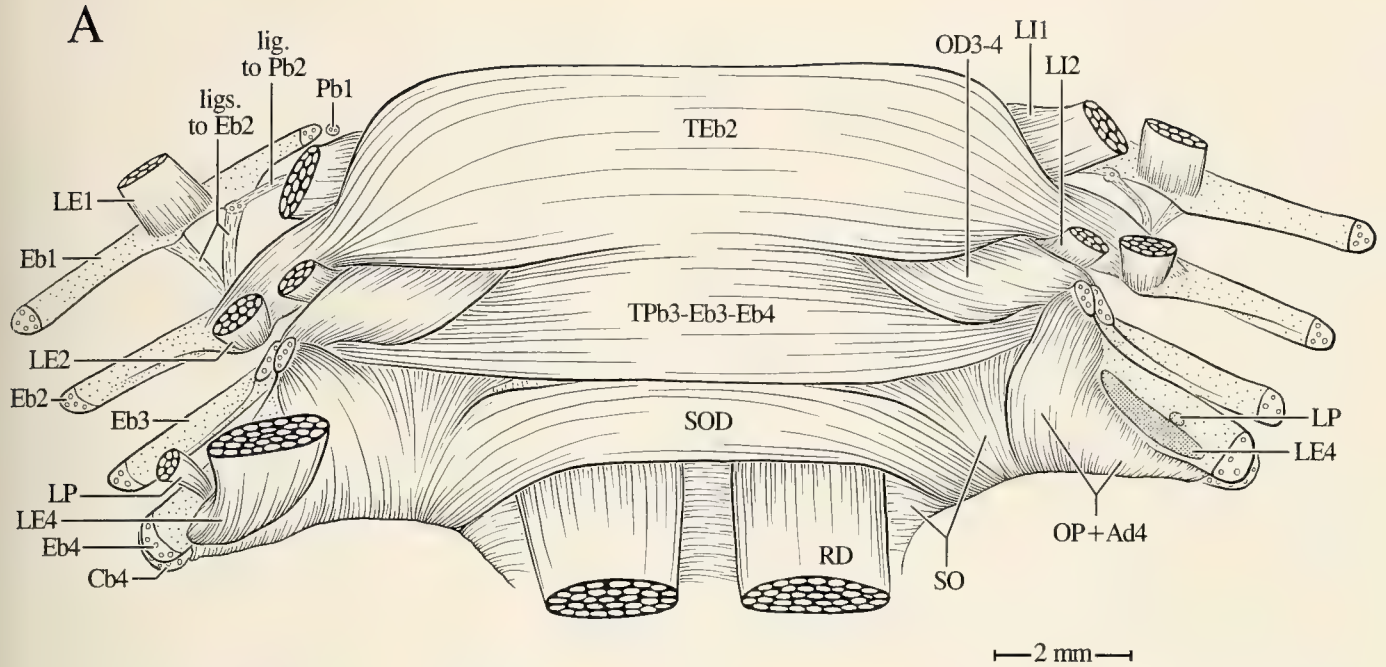




*Dicrolene*  
(Ophidiidae)

Plate 65. *Dicrolene intronigra*, USNM 362557: A, dorsal view, right-side OD3-4 cut away and LE1, LE3, and LE4 removed (insertion positions indicated by shading). B, posterior view, right side reversed.



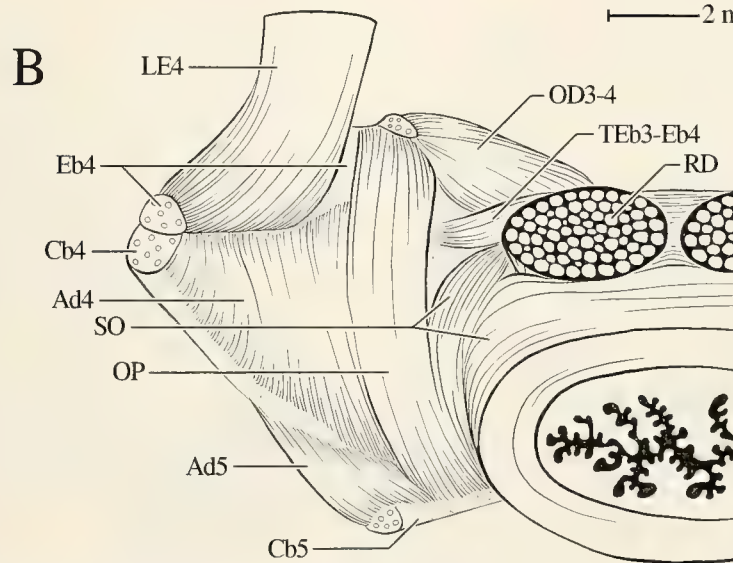
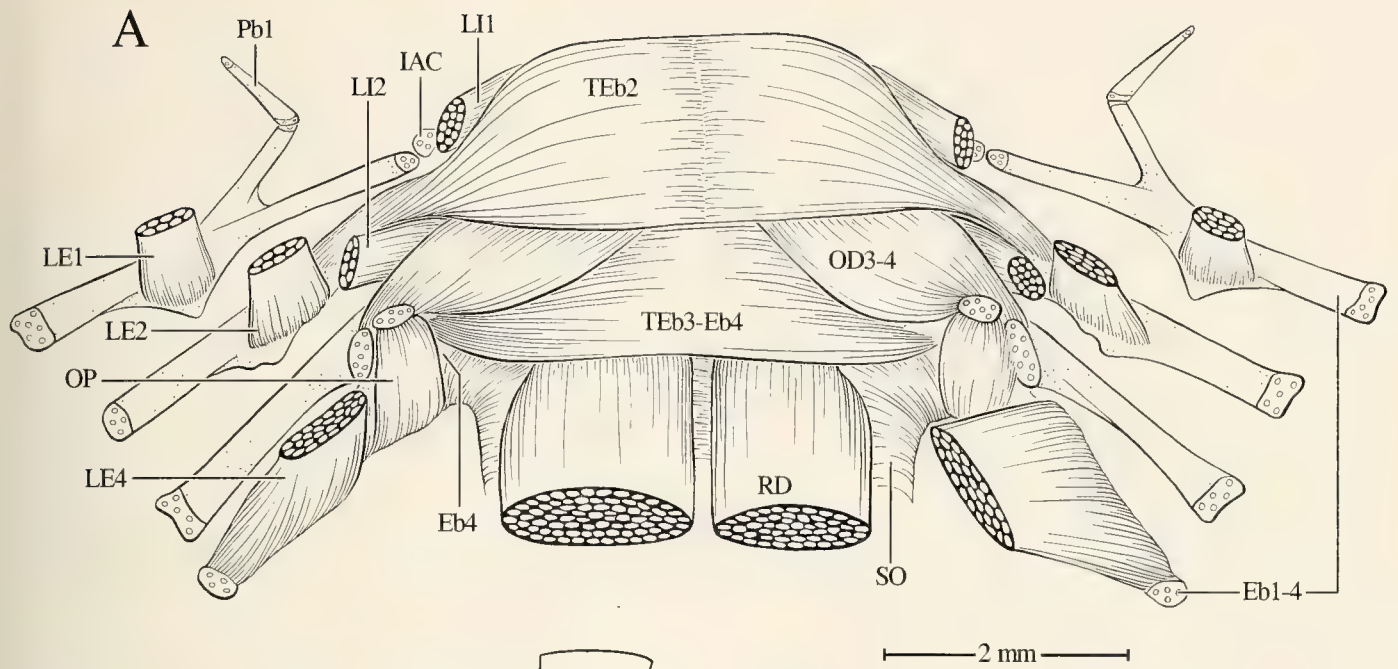


*Raniceps*  
(Ranicipitidae)

Plate 66. *Raniceps raninus*, USNM 345222: A, dorsal view, right-side LE4 and LP removed (insertion positions indicated by shading). B, posterior view, left side.







***Opsanus***  
(Batrachoididae)

Plate 67. *Opsanus beta*, USNM 301938: A, dorsal view. B, posterior view, left side, PCI removed (see remarks following OP in species account for description of relationships between PCI and OP and Ad5).



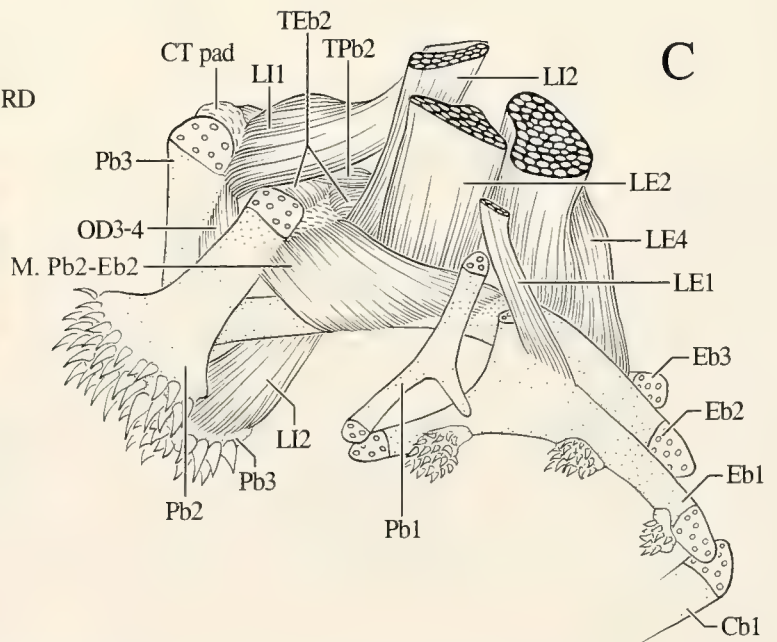
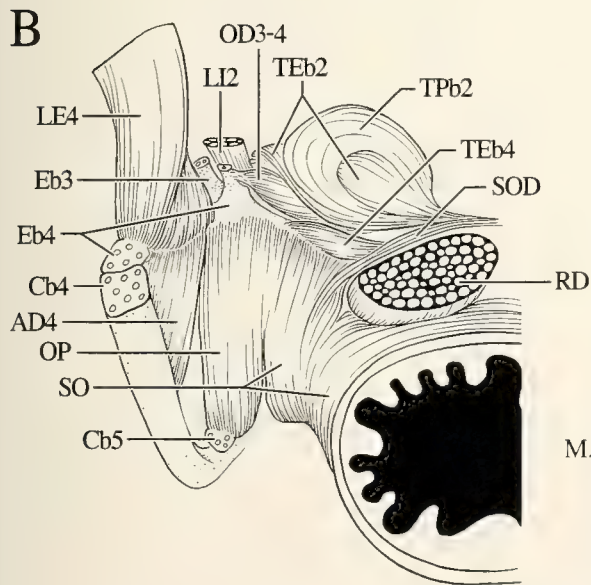
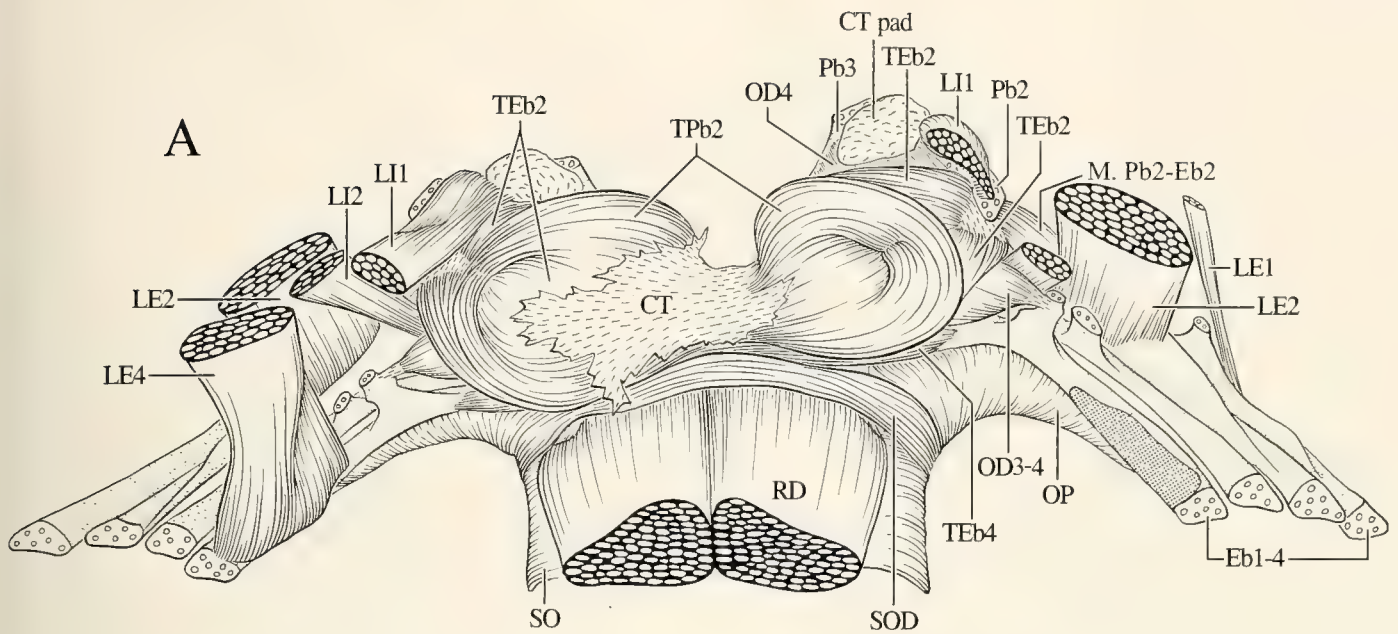
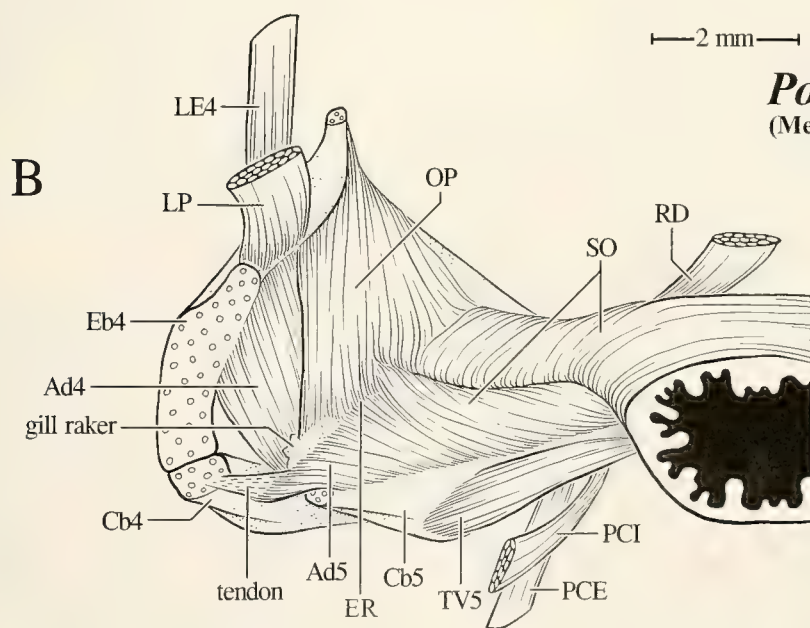
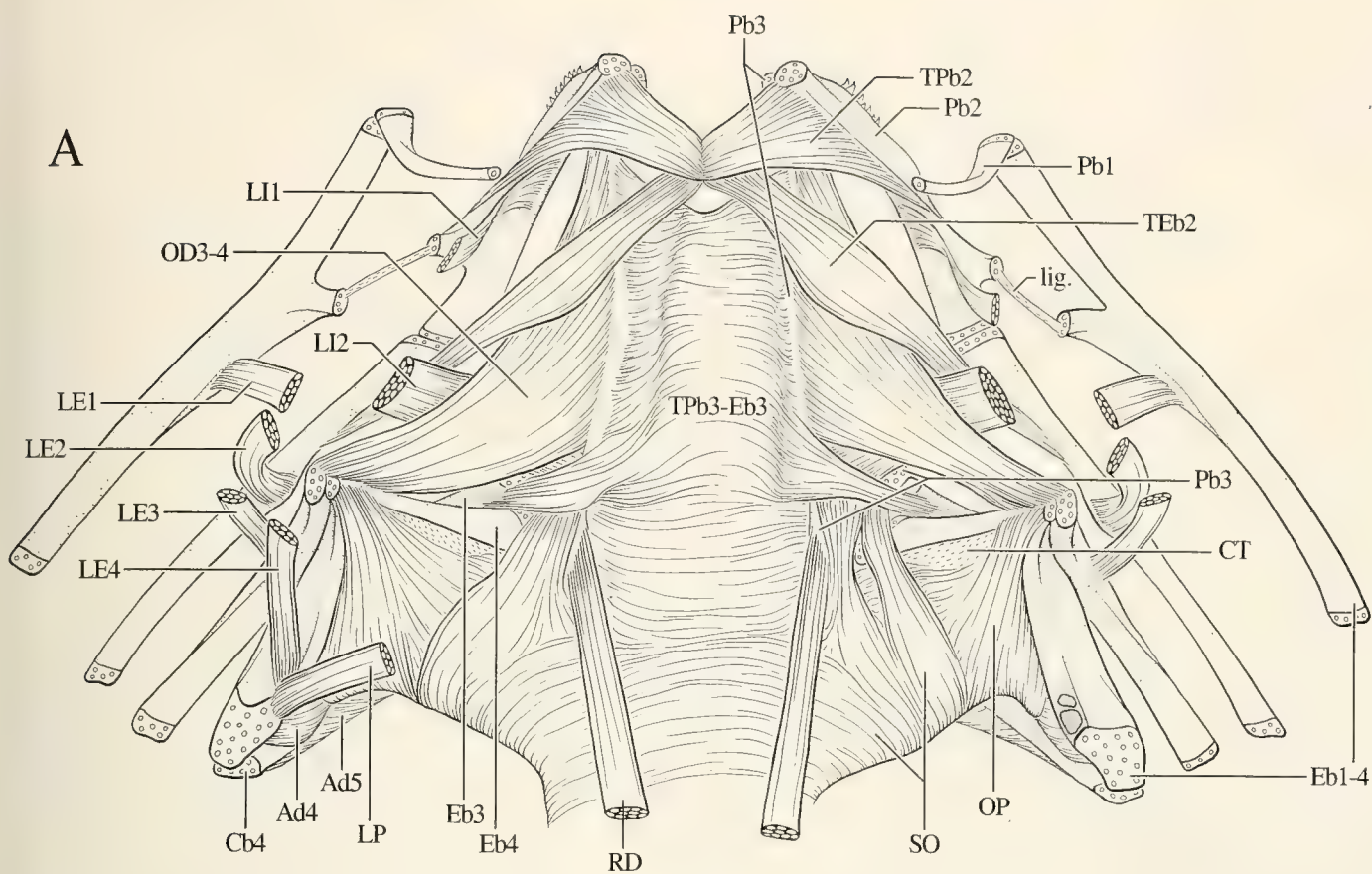


Plate 68. *Chaunax pictus*, USNM 187852: A, dorsal view, right-side LE4 removed (insertion position indicated by shading). B, posterior view, right side reversed. C, anterolateral view, left side.







***Poromitra***  
(Melamphaidae)

Plate 69. *Poromitra capito*, USNM 258325: A, dorsal view, right-side LP and LE4 removed (insertion positions indicated by shading). B, posterior view, left side, LP deflected laterally.



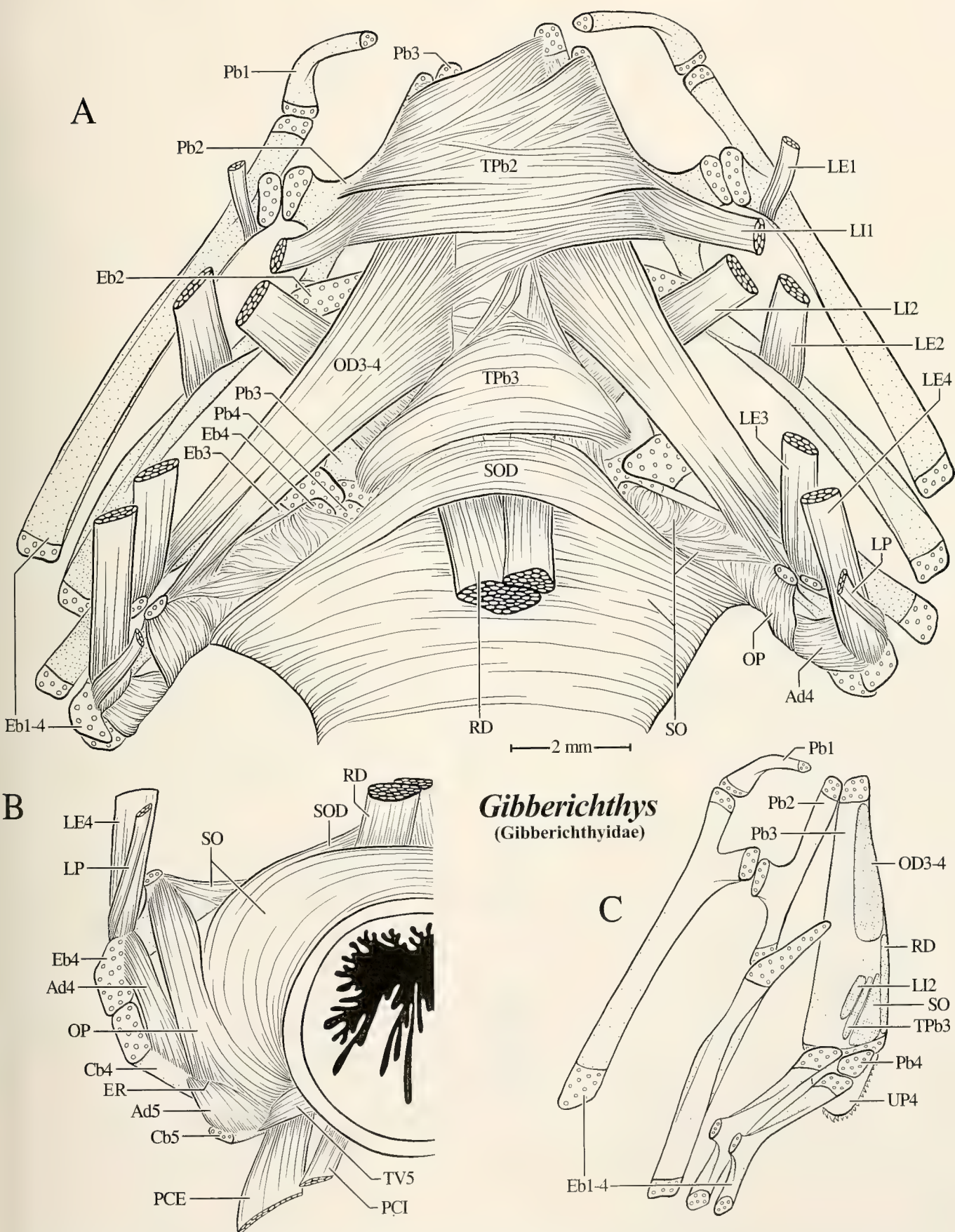


Plate 70. *Gibberichthys pumilus*, USNM 217207: A, dorsal view. B, posterior view, left side. C, dorsal view of gill-arch skeleton with approximate positions of muscle insertions on Pb3 indicated by shading, right-side reversed.





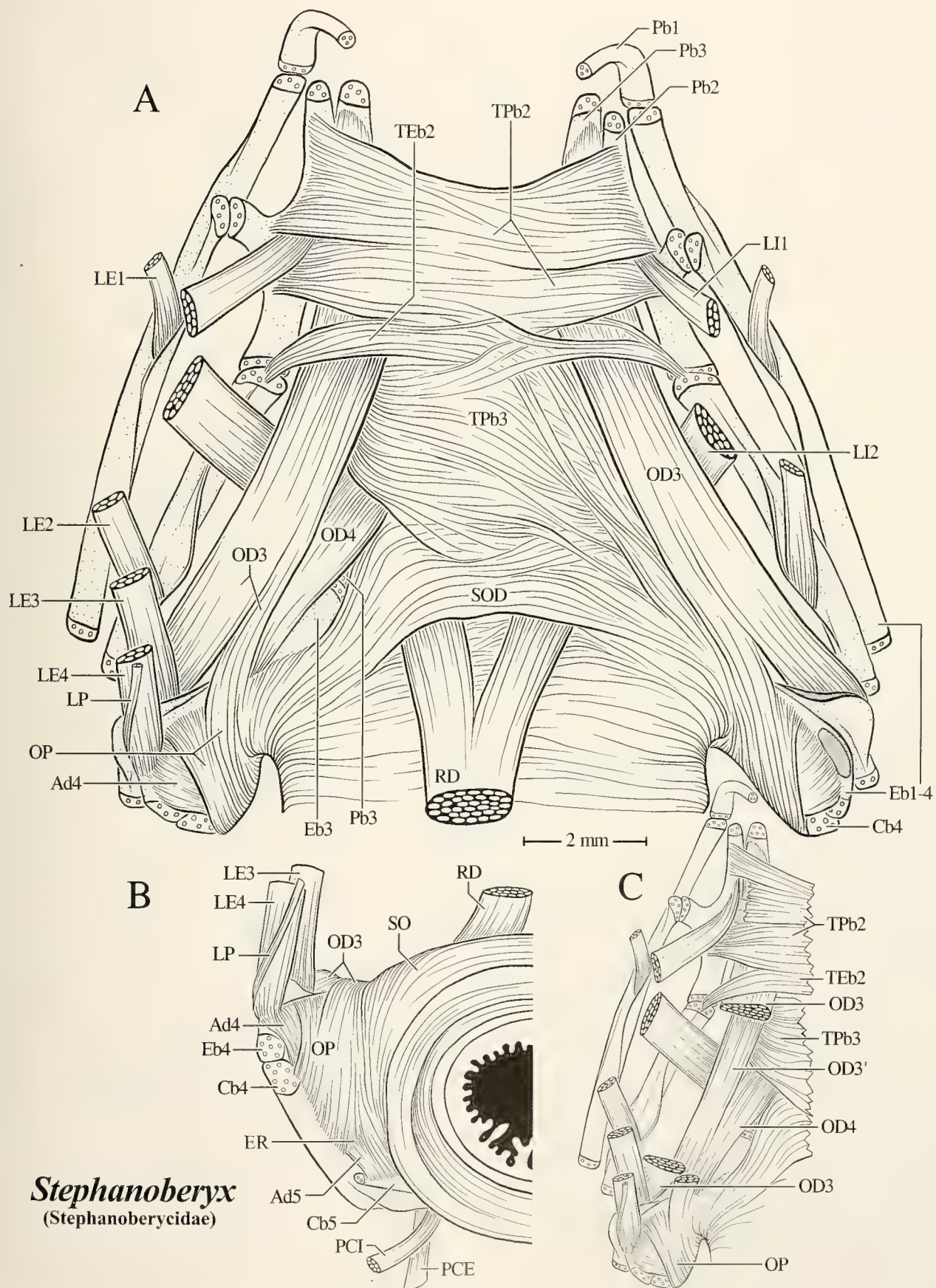


Plate 71. *Stephanoberyx monae*, USNM 304376: A, dorsal view, right side LE3, LE4, and LP removed, (insertion positions indicated by shading). B, posterior view, right side reversed. C, dorsal view left side, OD3 and OP cut away to reveal underlying OD3', anterior portion of TPb2 cut away to reveal LI1 insertion.



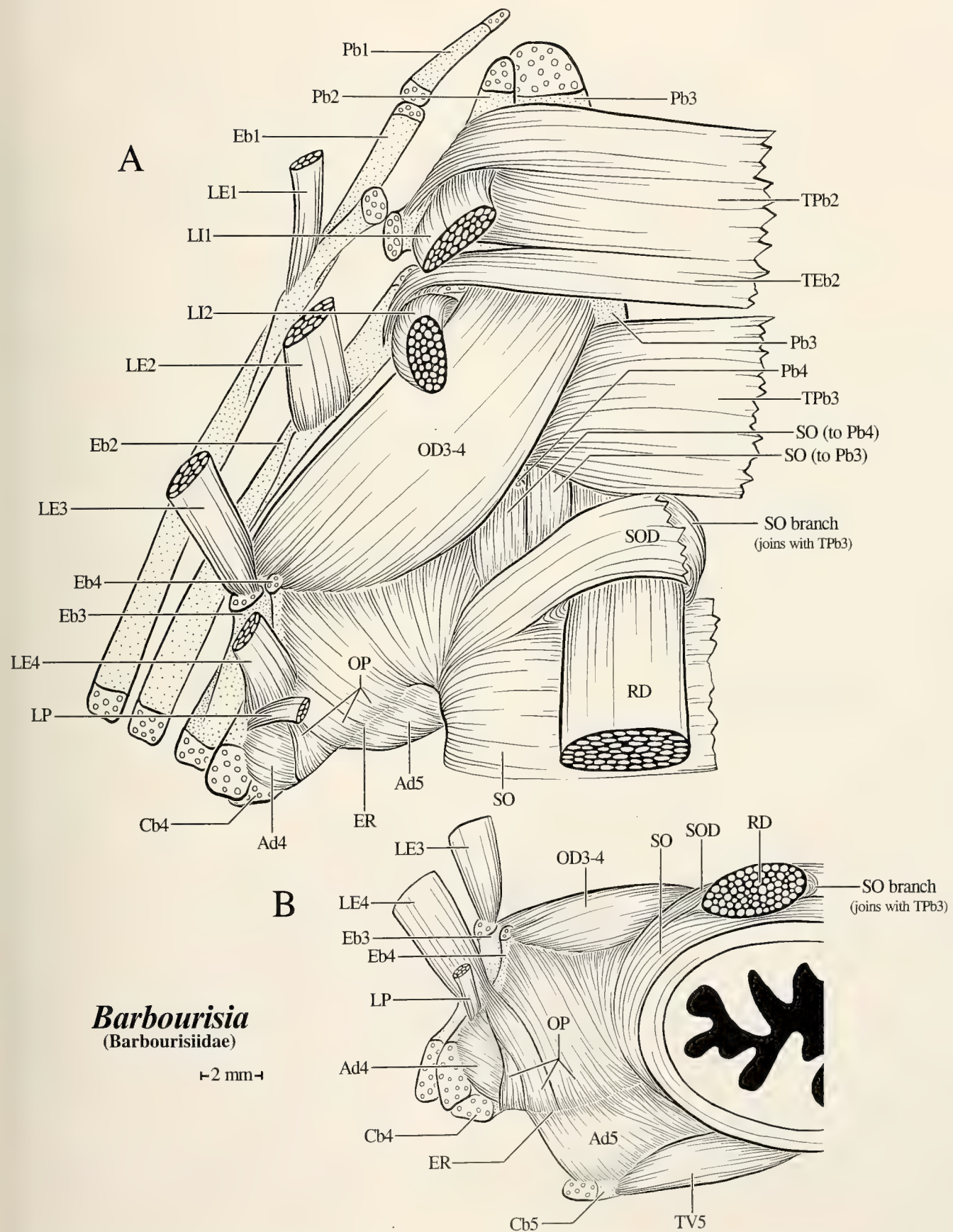
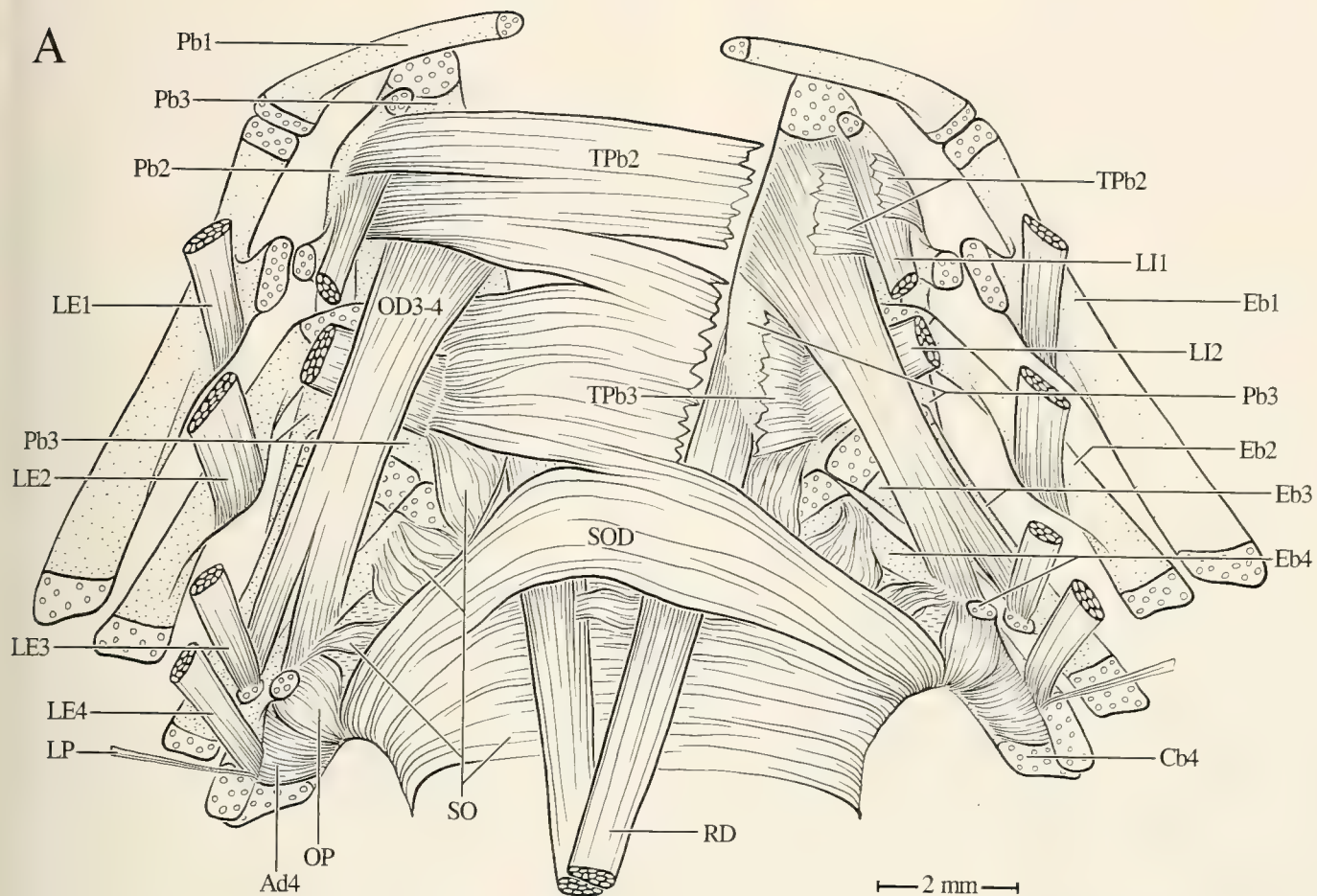


Plate 72. *Barbourisia rufa*, AMNH 29772: A, dorsal view: (only left-side gill arches available for study). A, posterior view, left side, levators forced laterally.







***Rondeletia***  
(Rondeletiidae)

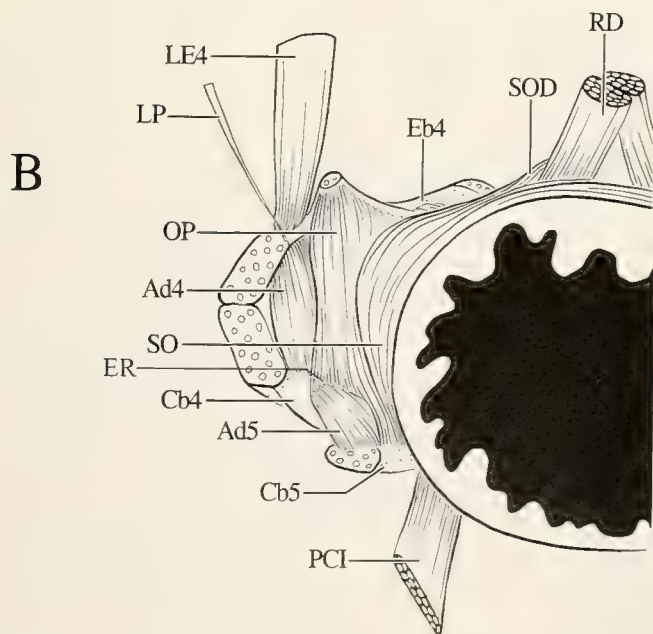


Plate 73. *Rondeletia loricata*, USNM 206836: A, dorsal view, right-side TPb2 and TPb3 cut away to reveal insertion of LI1 on Pb2 and Pb3 and insertion of RD on Pb3. B, posterior view, left side.



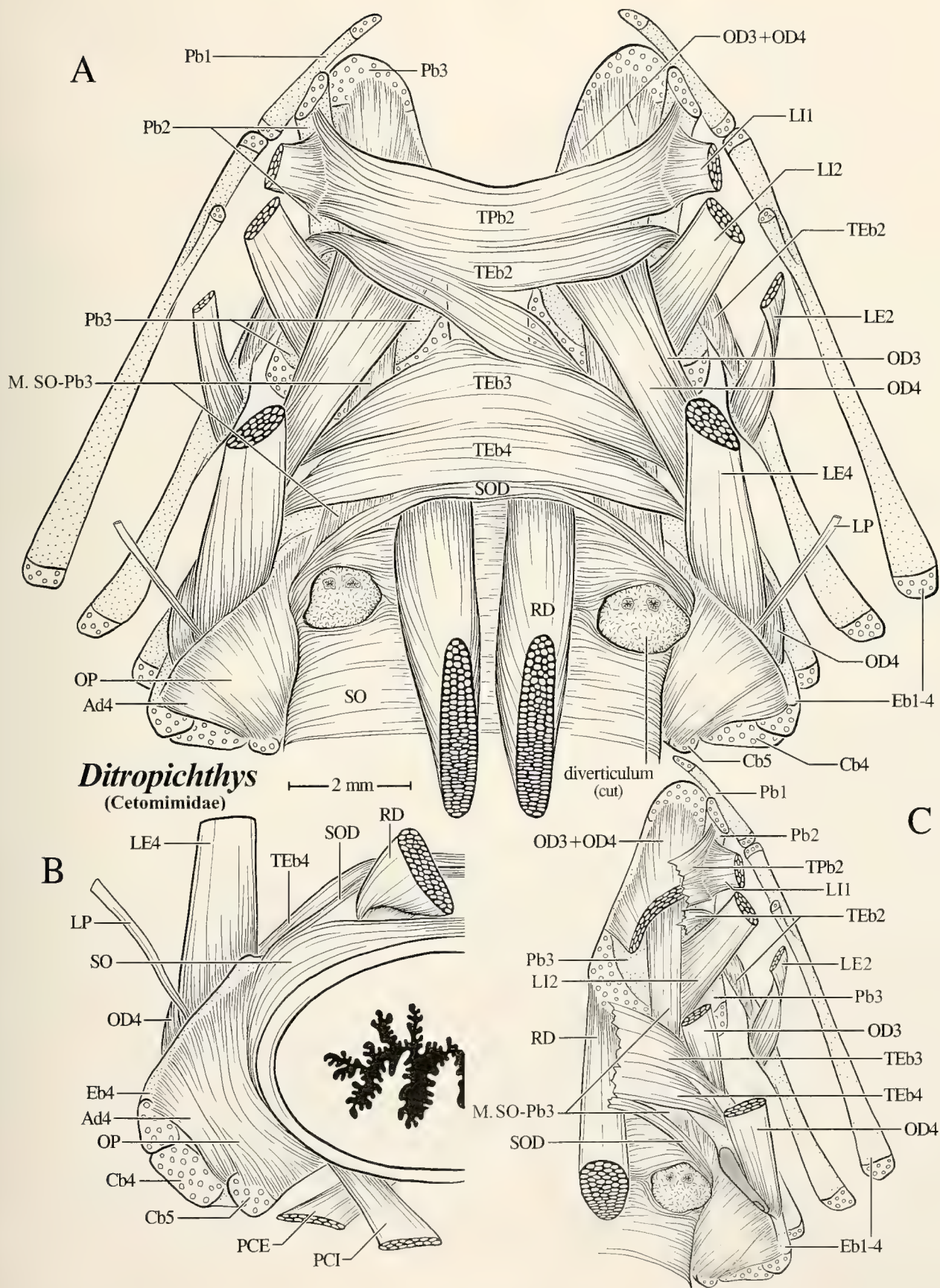


Plate 74. *Ditropichthys storeri*, SIO 64-24-25: A, dorsal view, openings of diverticula not detailed. B, posterior view, left side. C, dorsal view, right-side: LE4 and LP removed (insertion positions indicated by shading); TPb2, TEb2, TEb3, TEb4, SOD, and OD3-4 cut away to reveal M. SO-Pb3, RD insertion on Pb3, and epibranchial attachments of TEb3, TEb4, and OD3-4. Absence of LE1 should be verified in another specimen.





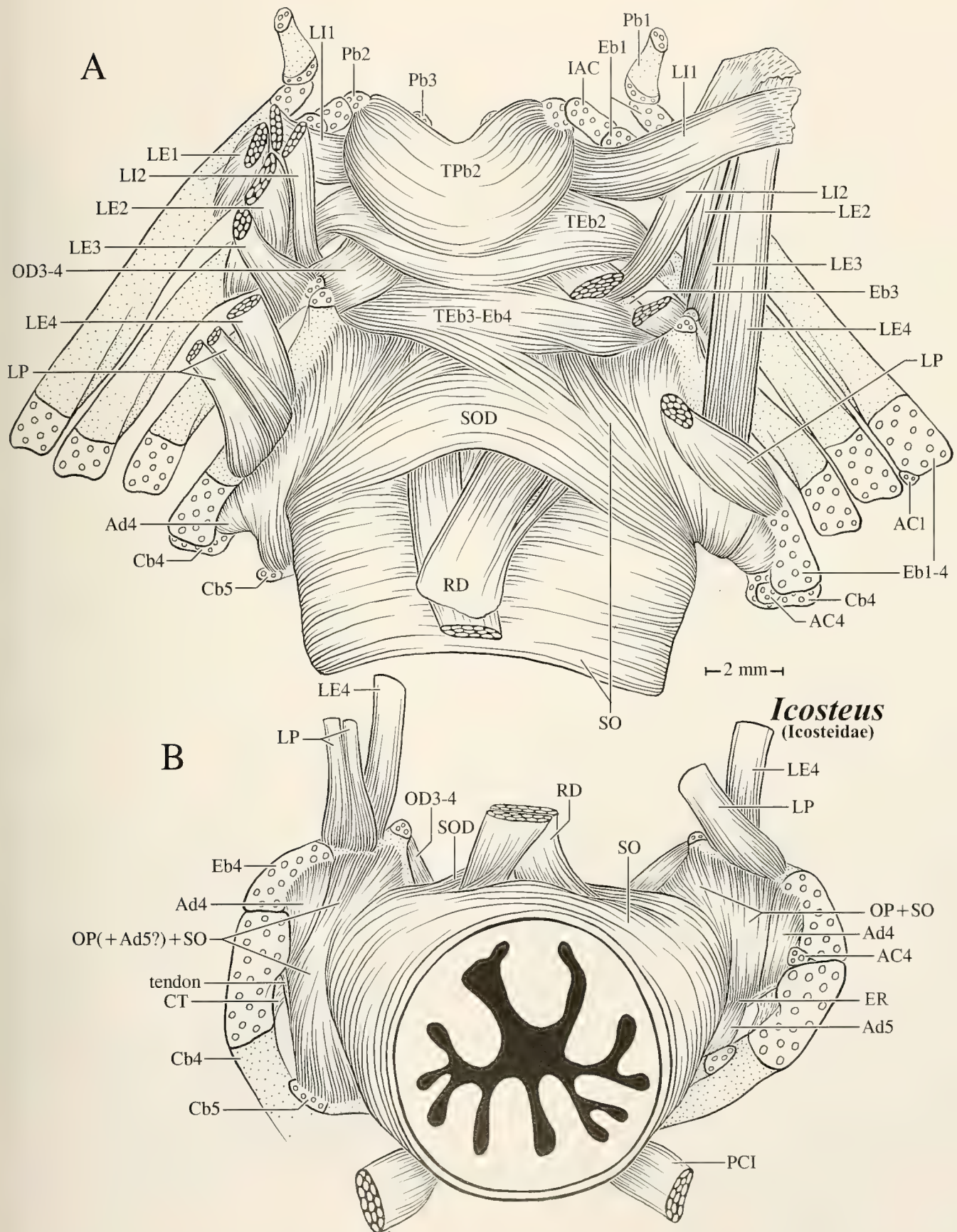
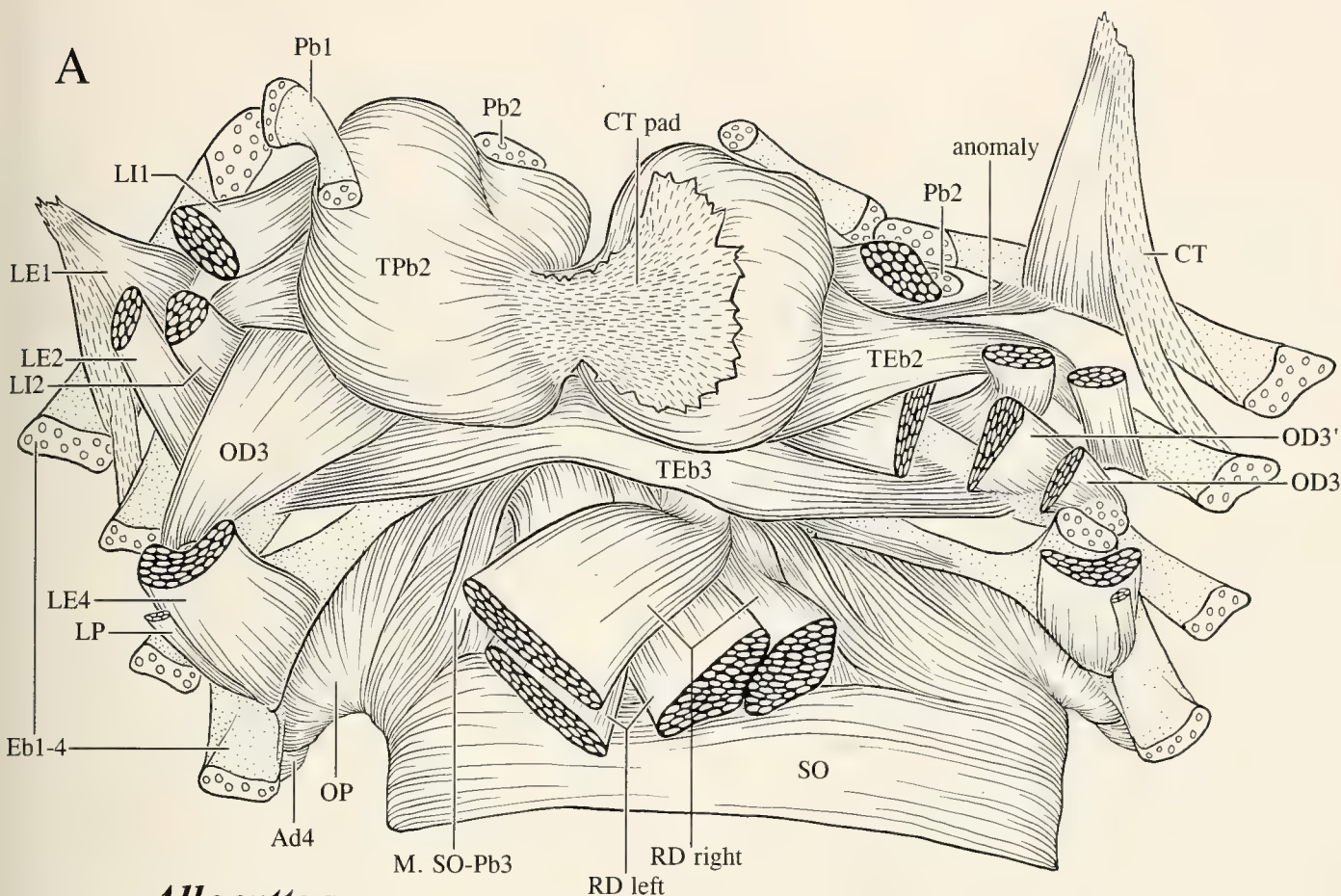


Plate 75. *Icosteus aenigmaticus*, LACM 35865-1: dorsal view: right-side OD3-4 bisected. B. posterior view (left side aberrant).







***Allocyttus***  
(Oreosomatidae)

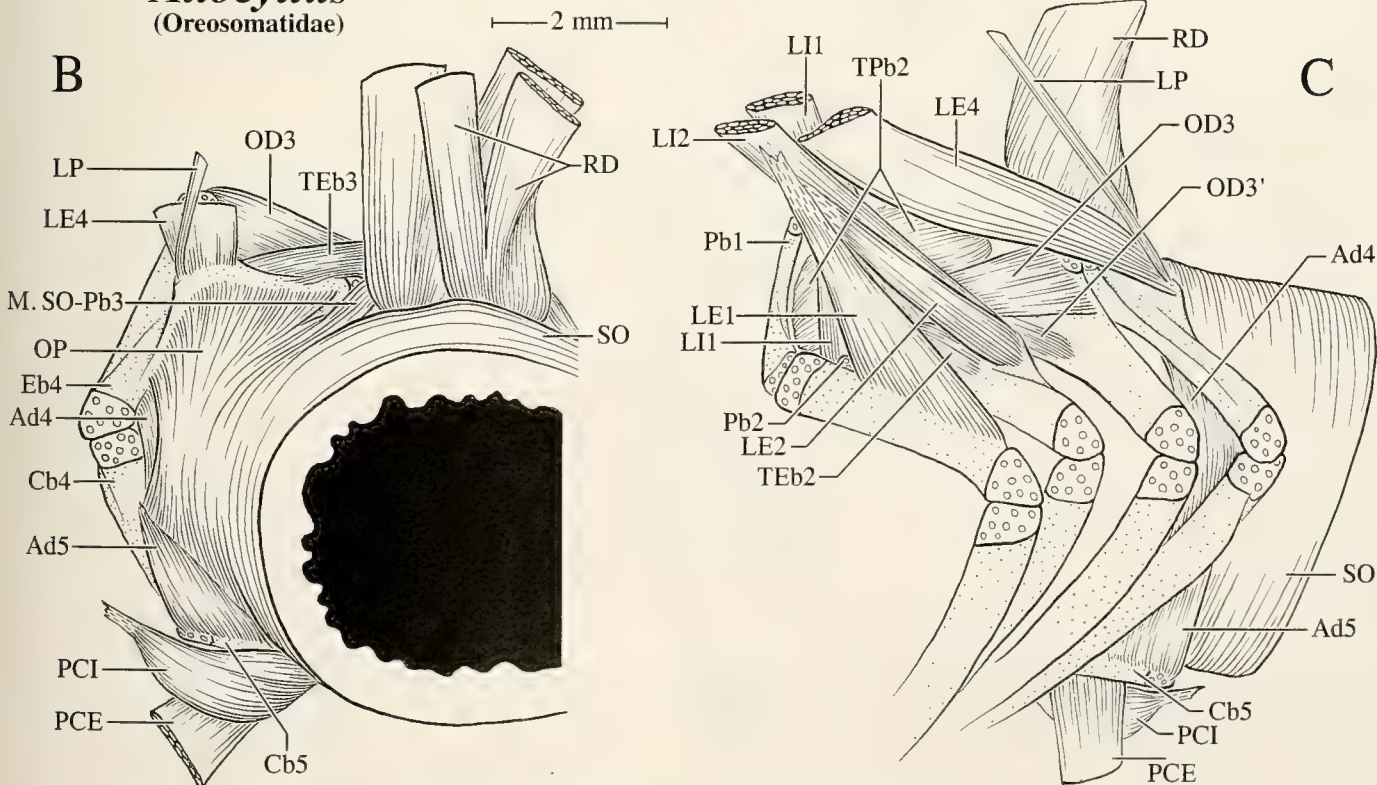
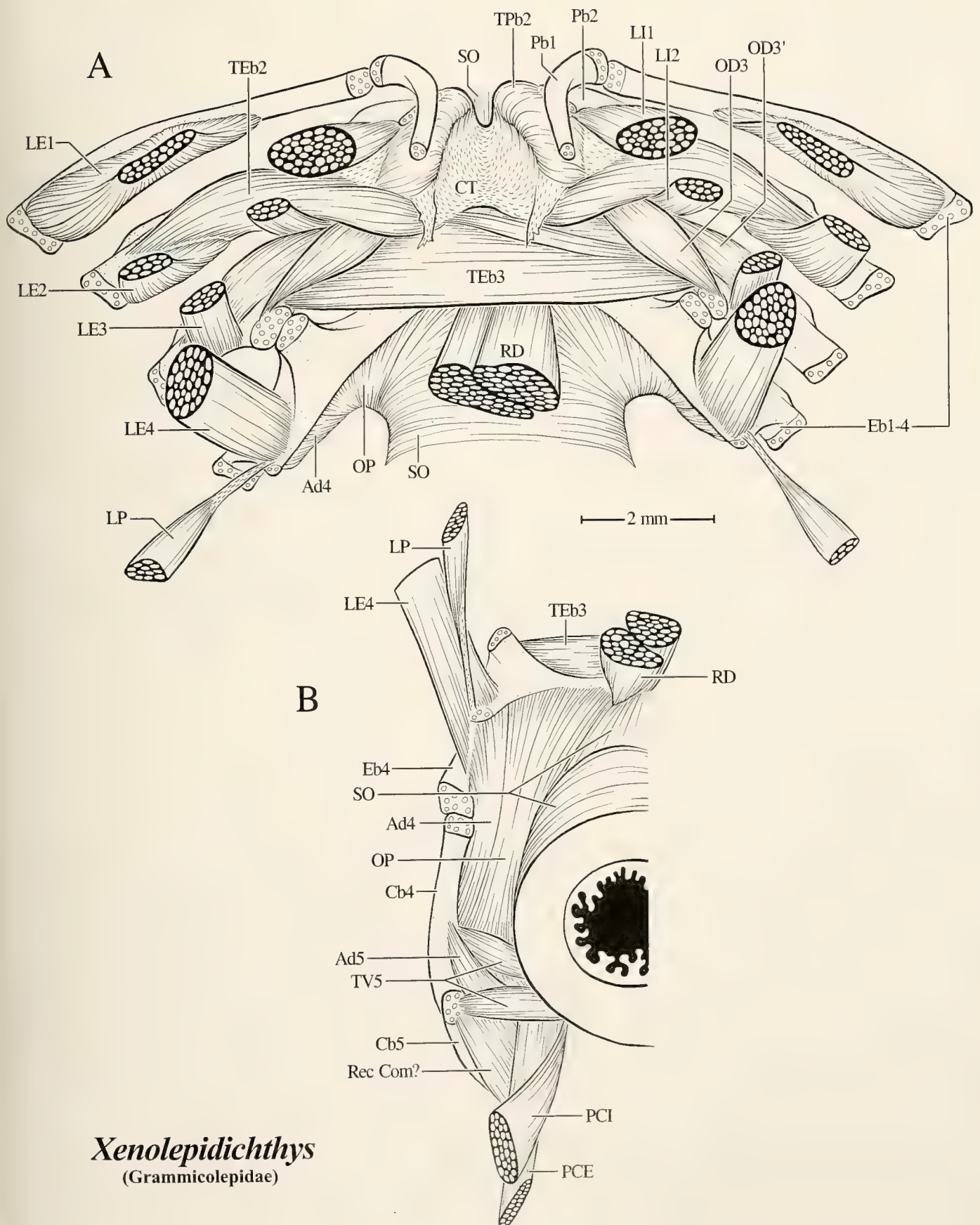


Plate 76. *Allocyttus verrucosus*, USNM 329365, levators variously truncated or unmodified: A, dorsal view (skewness of muscles probably abnormal), TPb3 not visible; right-side OD3 and OD3' bisected, note anomalous muscle slip on Eb1; left-side CT pad removed from TPb2; B, posterior view, right side reversed; C, lateral view, left side.





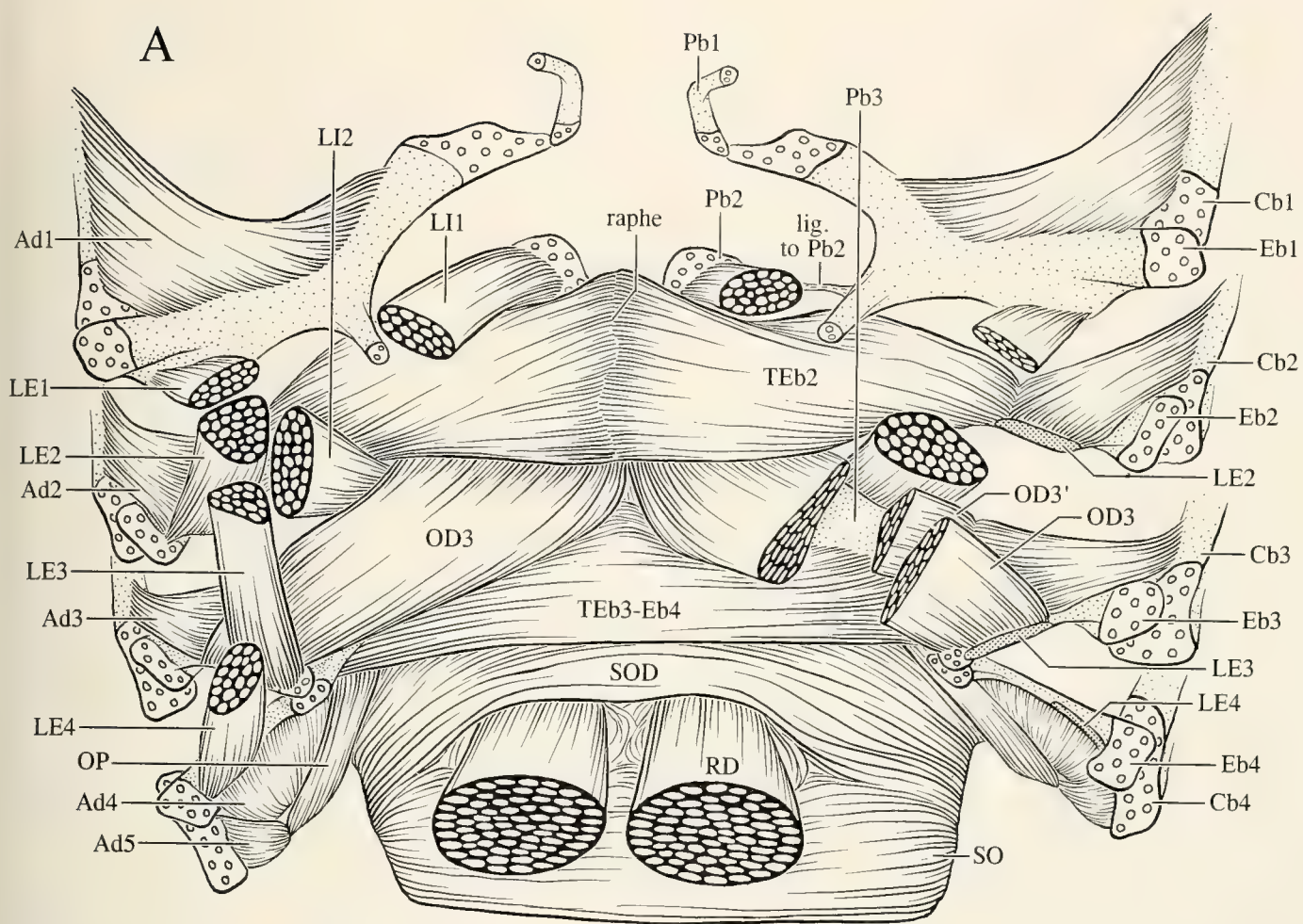


*Xenolepidichthys*  
(Grammicolepididae)

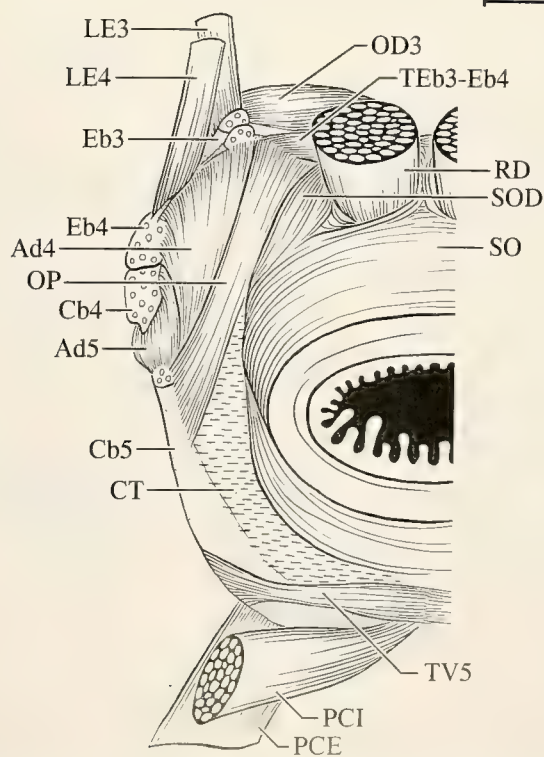
Plate 77. *Xenolepidichthys dalgleishi*, USNM 341954: A, dorsal view, lateral ends of Eb1 and Eb2 on both sides pivoted slightly anteriorly. B, posterior view, left side.



A



B



**Capros**  
(Caproidae)

Plate 78. *Capros aper*, USNM 289207: A, dorsal view, right-side OD3 and OD3' bisected; right-side LE2, LE3, and LE4 removed, insertion positions shown by shading; left-side Pb2-Eb1 ligament removed. B, posterior view, left side.





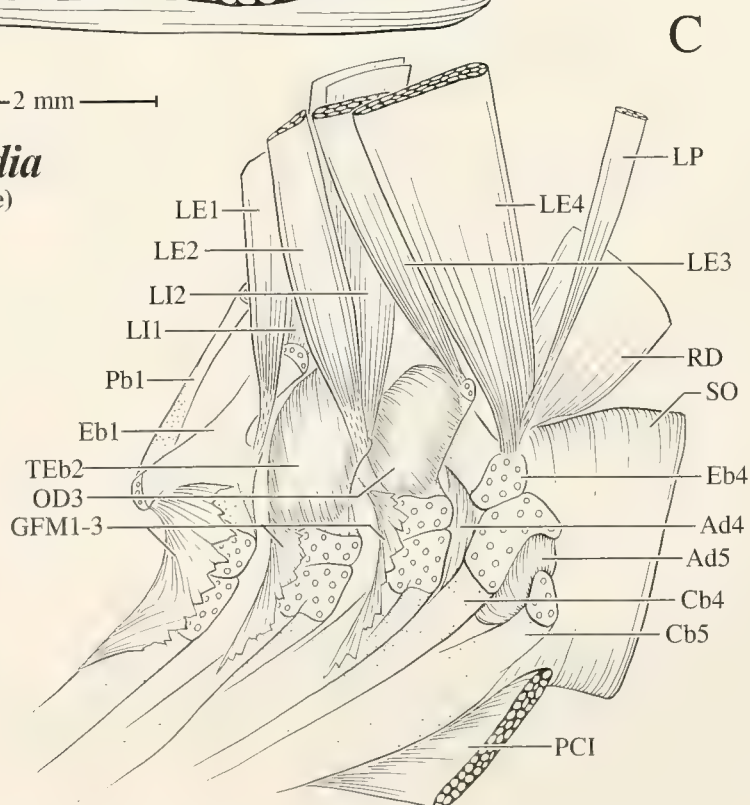
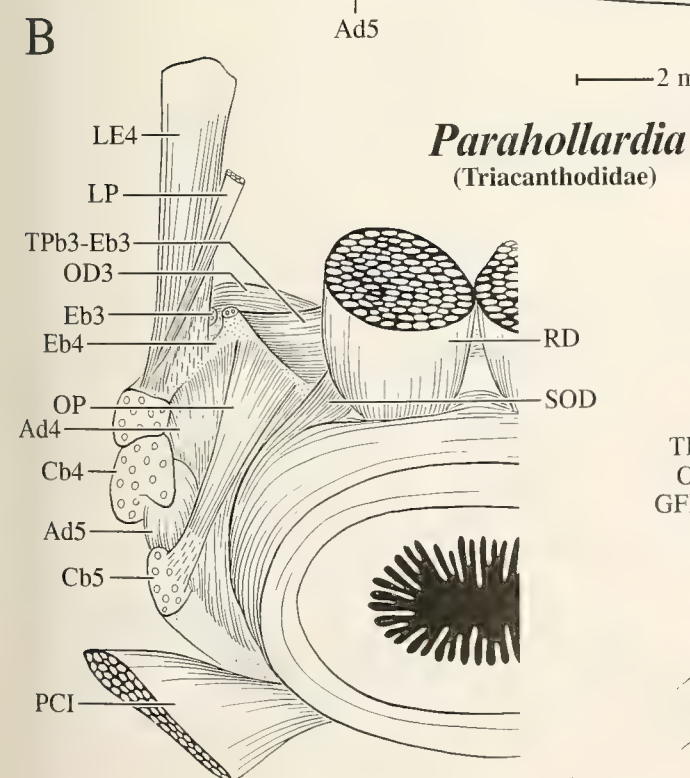
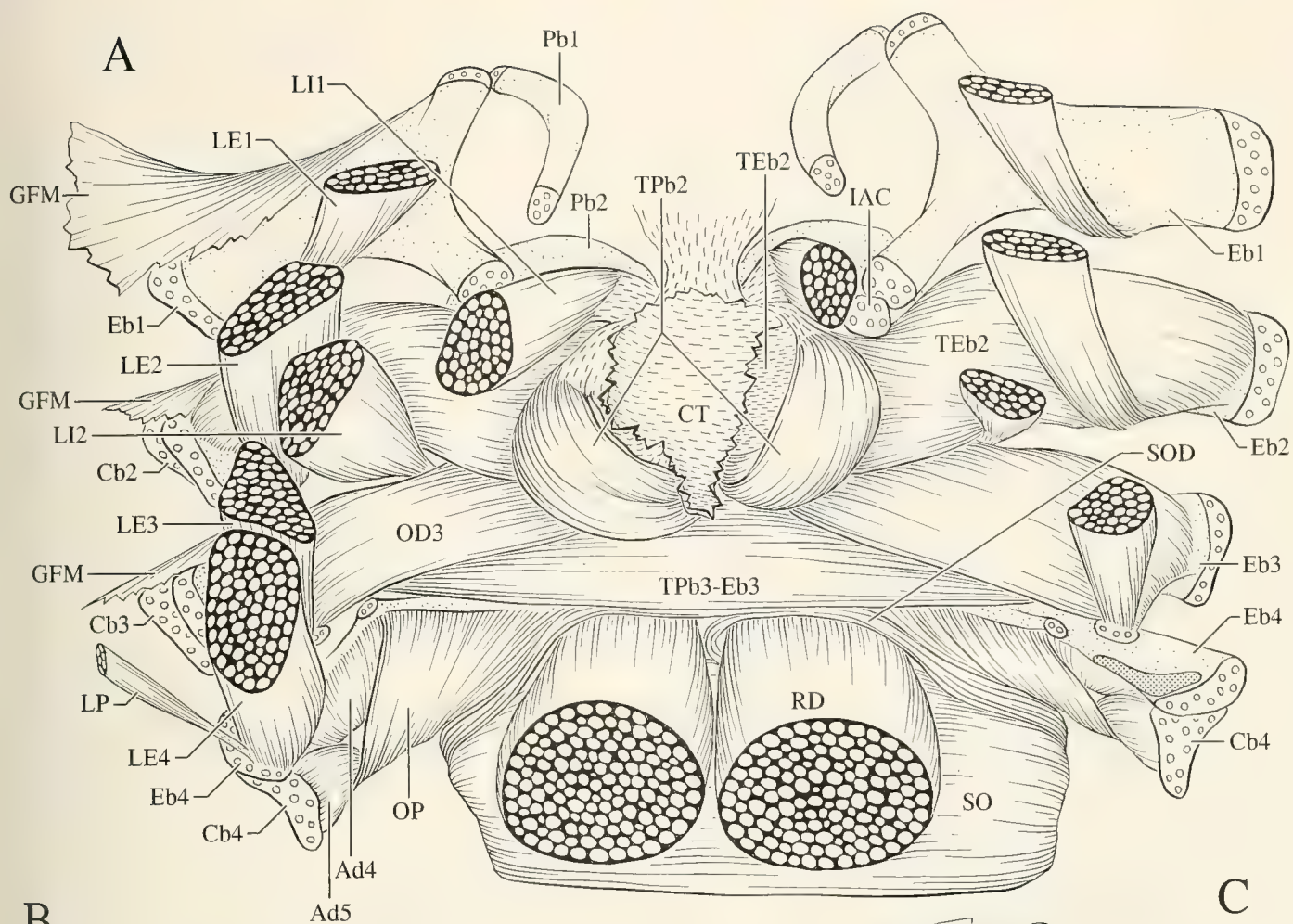
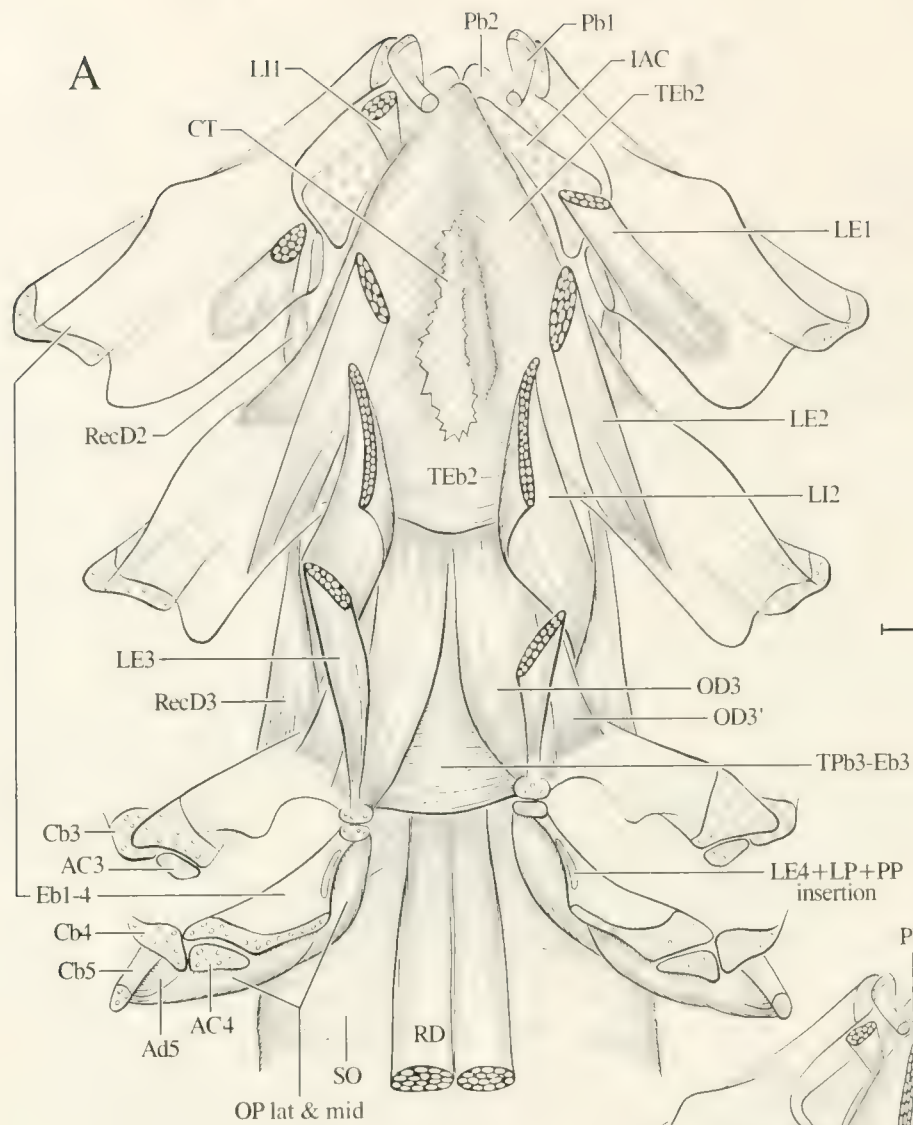
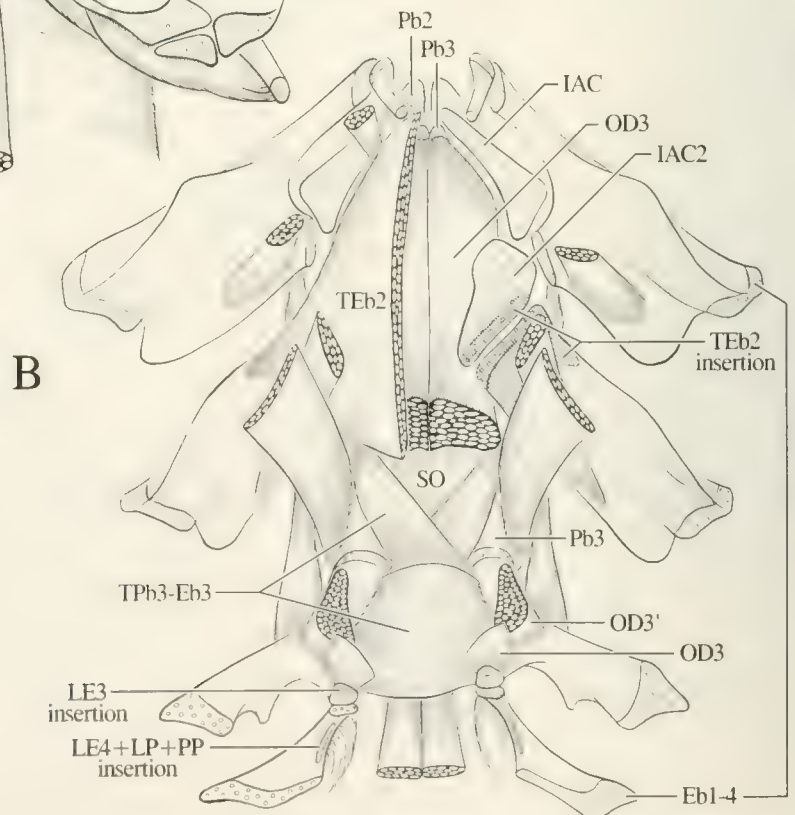


Plate 79. *Parahollardia lineata*, USNM 287252: A, dorsal view, right-side OD3-4 cut away to reveal underlying muscle attachments and LE4, LP, and GFMs removed (joint LE4-LP insertion position indicated by shading). B, posterior view: right-side reversed. C, lateral view, left side.

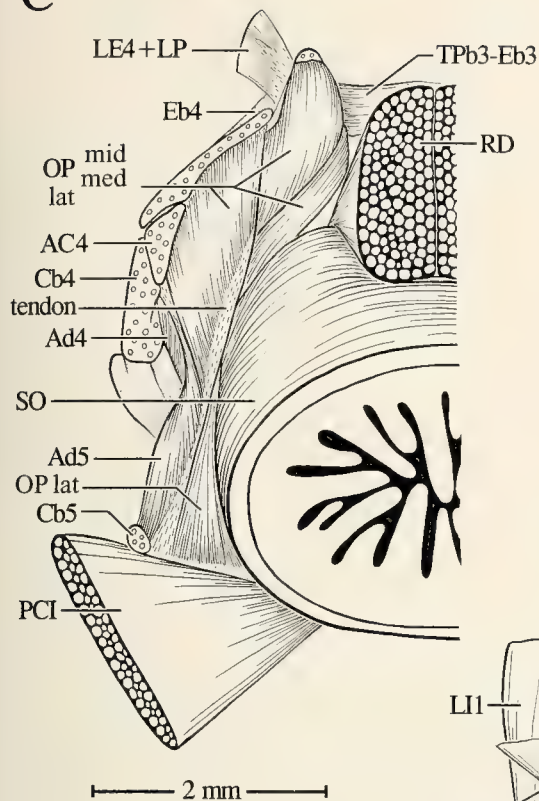


***Mene***  
(Menidae)

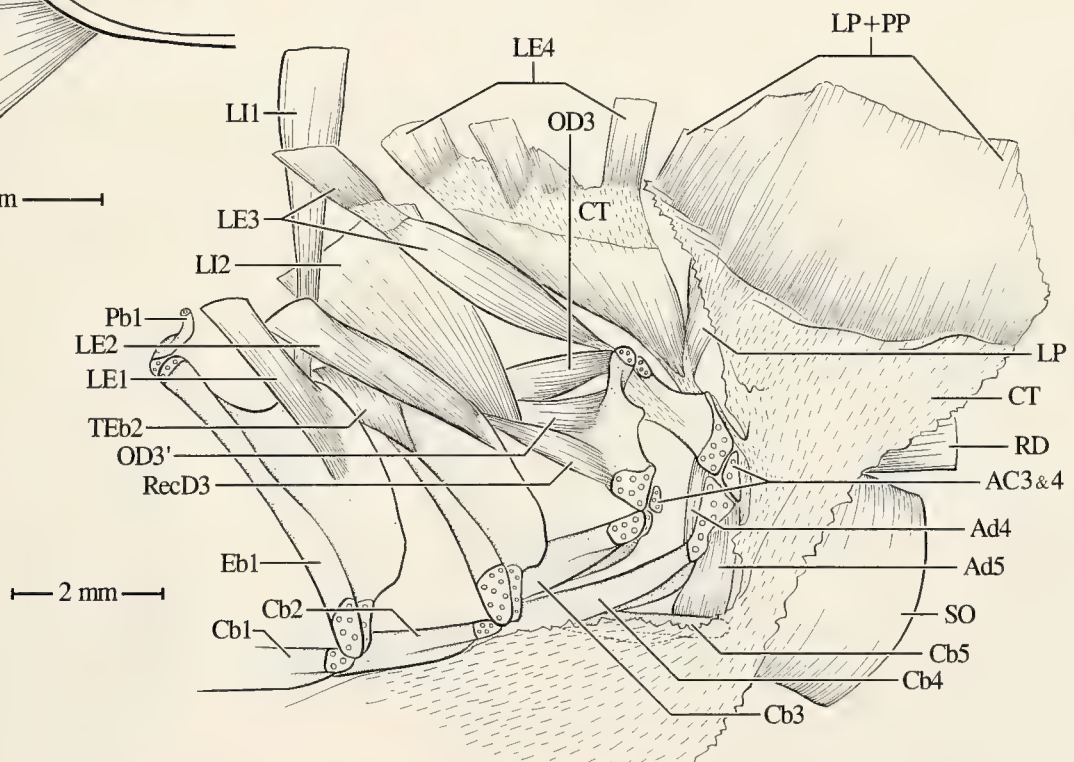




C

*Mene*

D



Plates 80.1, 80.2. *Mene maculata*, USNM 347107: A, dorsal view, right-side LI1 removed, CT pad on mid-line of TEb2 cut away, LE4-LP-PP removed (insertion position indicated by shading), Eb1s pivoted slightly anteriorly (breaking articulation with IAC2 (see B)). B, dorsal view (as in A), right-side TEb2 and both LE3s removed (LE3 insertion positions indicated by shading), both OD3s and OD3's bisected; articulation of IAC2 with underlying Pb2 not shown. C, posterior view, left side, LE4-LP truncated, PP removed; Ad5 attaches to Cb5, OP lat tendon, AC4, Cb4 posterodistally; ER present, not visible in view. D, lateral view, left side, portion of CT associated with LP + PP cut away to reveal Ad5 and Cb5; RecD2 not visible.





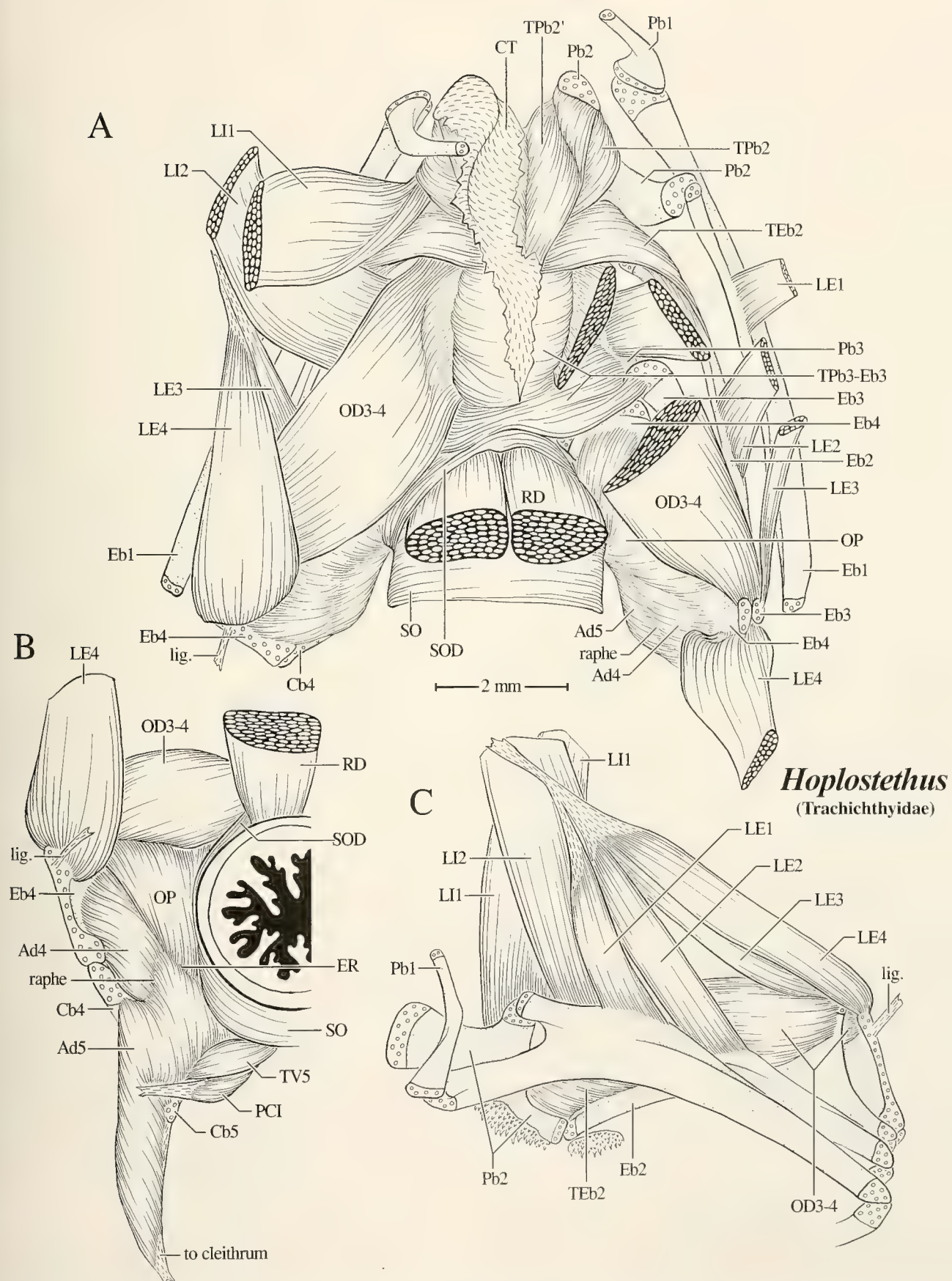
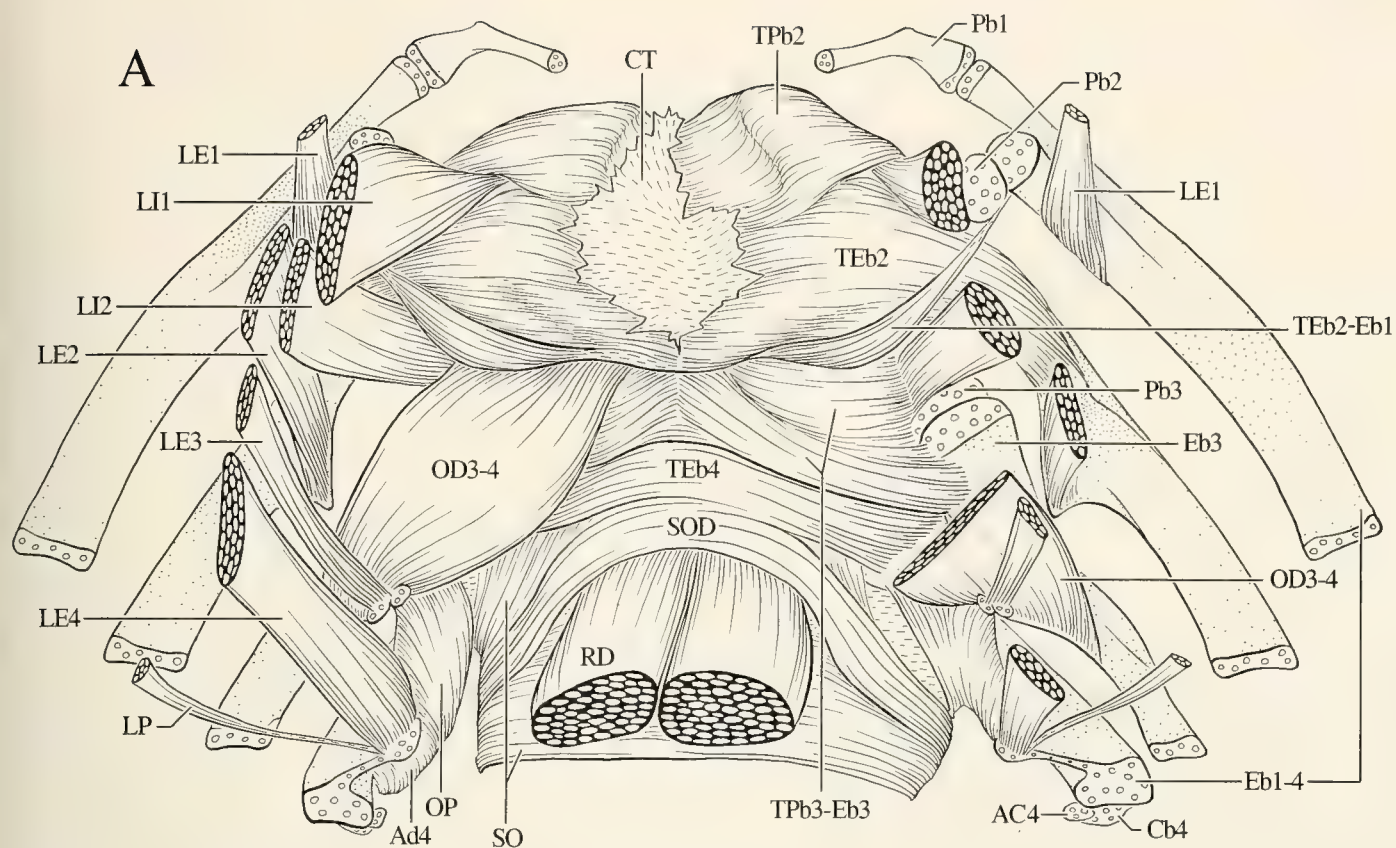
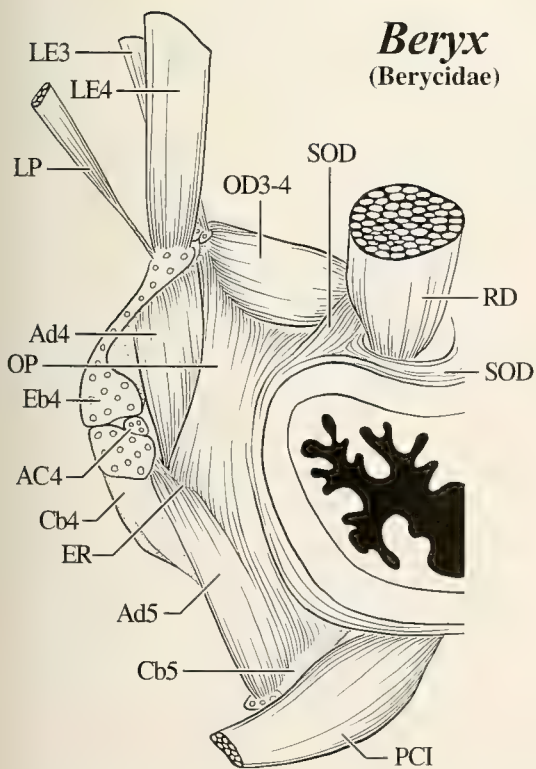


Plate 81. *Hoplostethus mediterraneus*, USNM 307273: A, dorsal view; right-side modifications: CT cut away to reveal thin sheet of muscle fibers composing TPb2', OD3-4 cut away to reveal attachments of TPb3-Eb3 and LI2, Pb1 forced anteriorly, LE4 forced posteriorly. B, left-side posterior view. C, left-side lateral view.





B



C

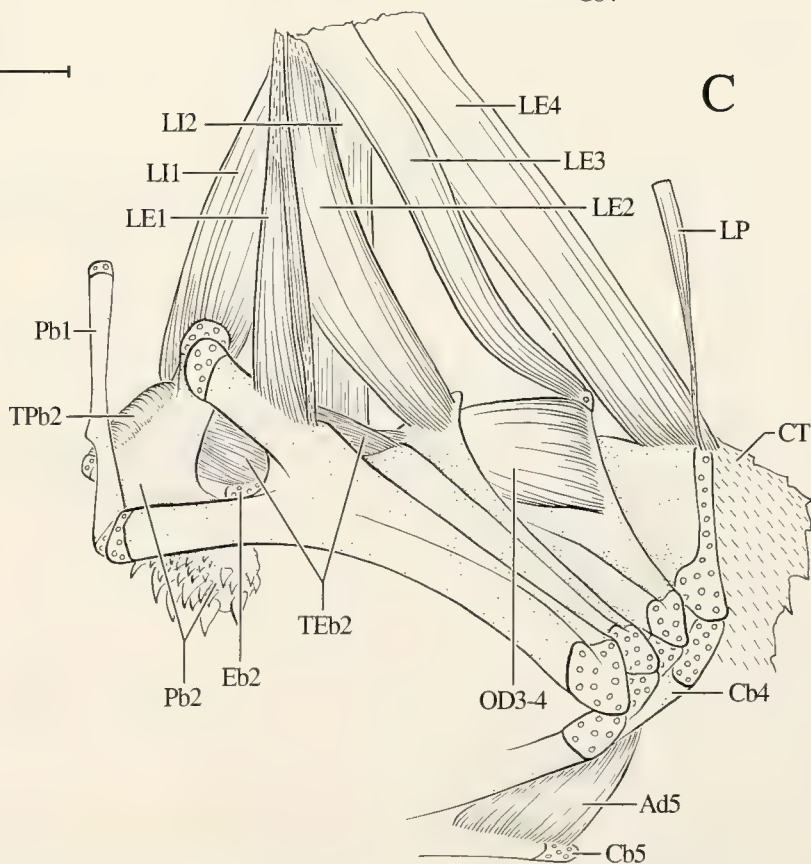
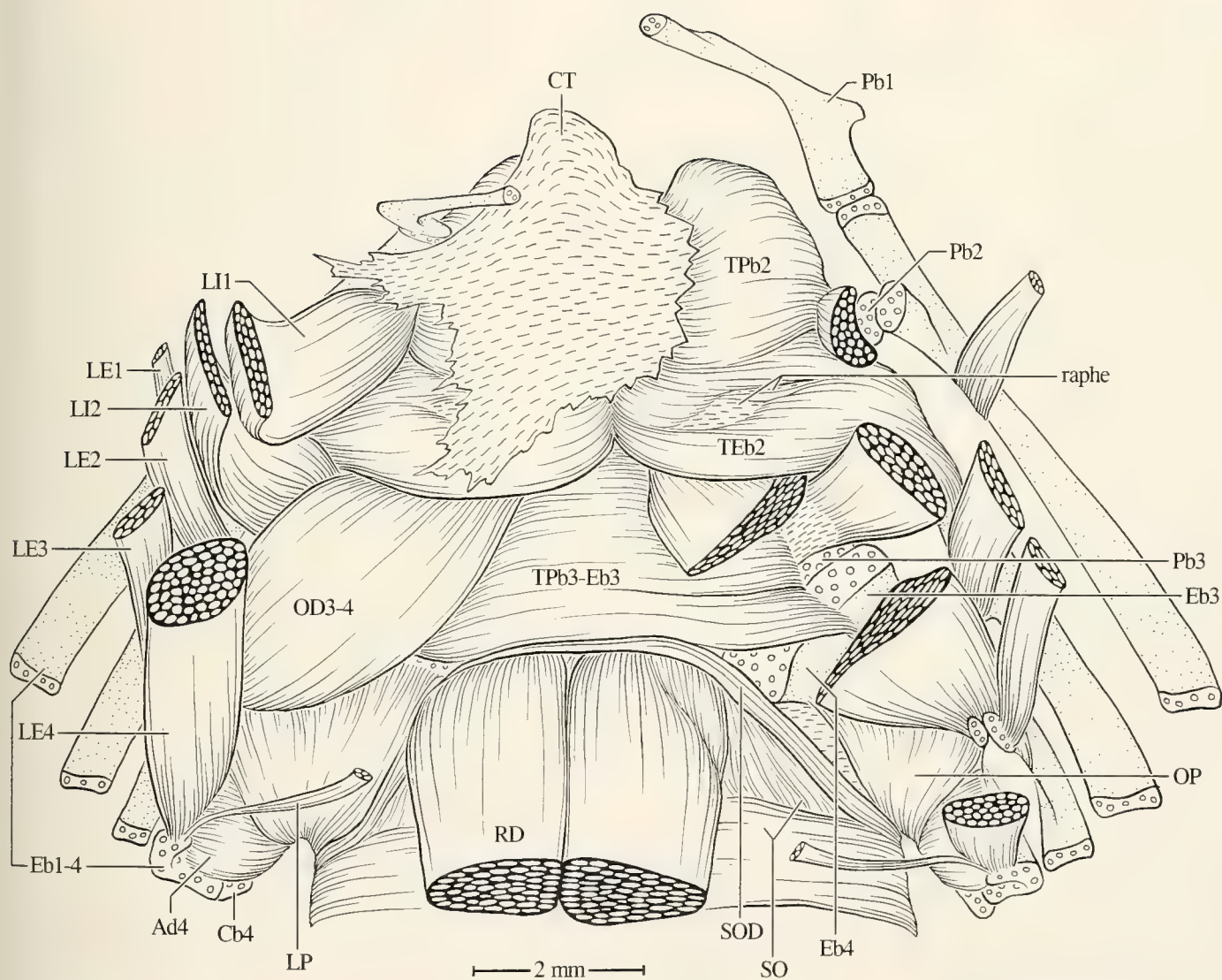


Plate 82. *Beryx splendens*, USNM 306143: A, dorsal view: right side OD3-4 cut away (anterior part not shown) to reveal insertion of LI2 and attachments of TPb3-Eb3 and TPb4. B, posterior view, right side reversed. C, lateral view, left side.







***Centroberyx***  
(Berycidae)

Plate 83. *Centroberyx affinis*, USNM 176984: dorsal view; right-side dorsal CT sheets cut away, Pb1 forced anteriorly, and OD3-4. Posterior view, not shown, is like that of *Hoplostethus mediterraneus*, Plate 81B.



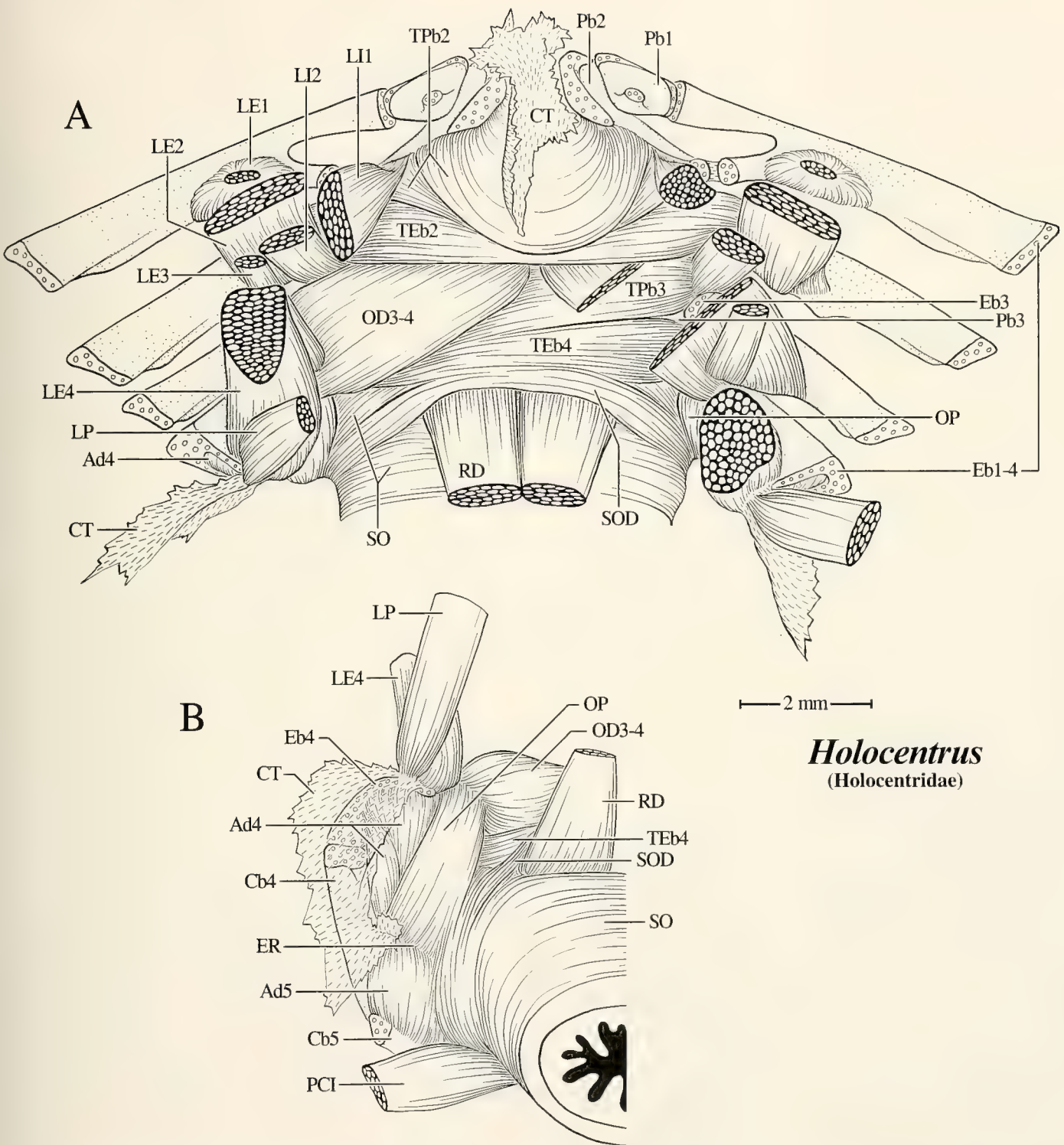


Plate 84. *Holocentrus adscensionis*, USNM 345408: A, dorsal view, right-side dorsal CT sheet cut away, OD3-4 cut away (to reveal attachments of LI2 and TPb3-Eb4), LP forced posterolaterally to reveal tendinous connection to LE4. B, posterior view: right side, reversed.





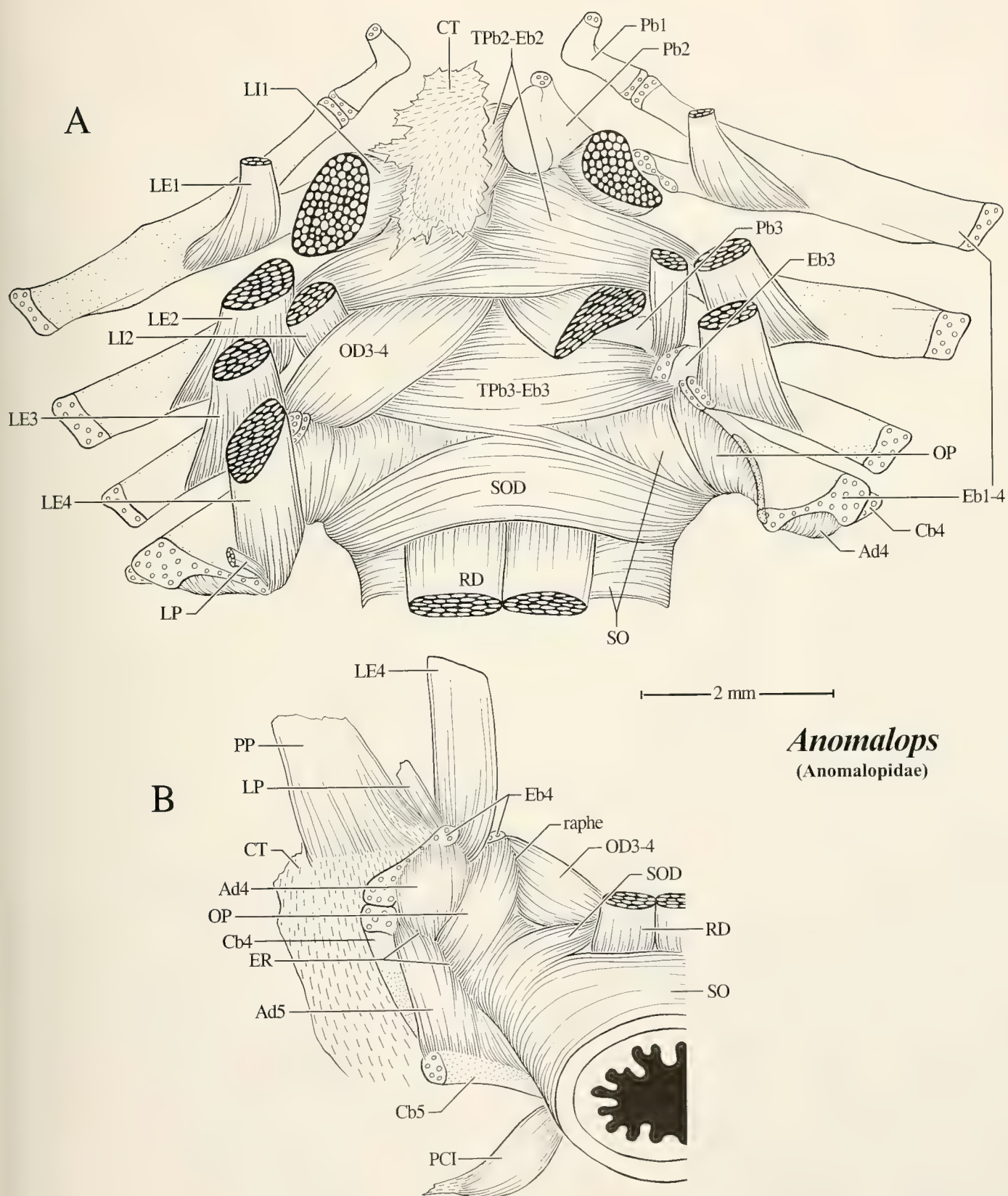


Plate 85. *Anomalops katoptron*, SIO-75-466: A, dorsal view, minute IAC and PP and associated CT not shown, right-side OD3-4 cut away and LE4 and LP removed (joined insertion positions indicated by shading). B, posterior view, right side reversed.



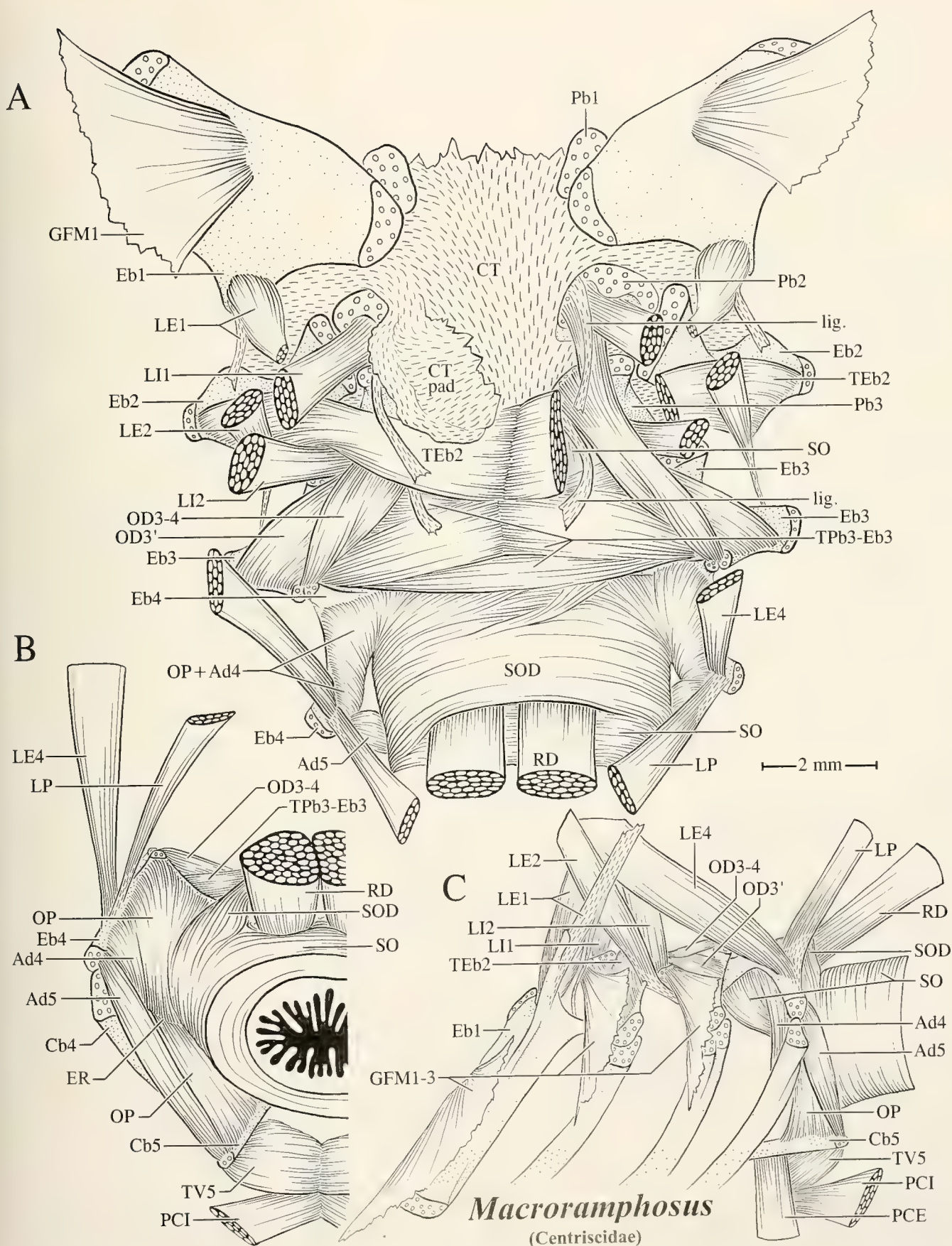


Plate 86. *Macroramphosus scolopax*: A, USNM 366546: dorsal view. GFM1 and 2 removed on both sides, right-side CT pad removed and TEb2 bisected, OD3' not visible. B, USNM 158813, posterior view, left side, with LE4 and LP added from USNM 366546. C, USNM 366546 and 158813, composite left-side lateral view.

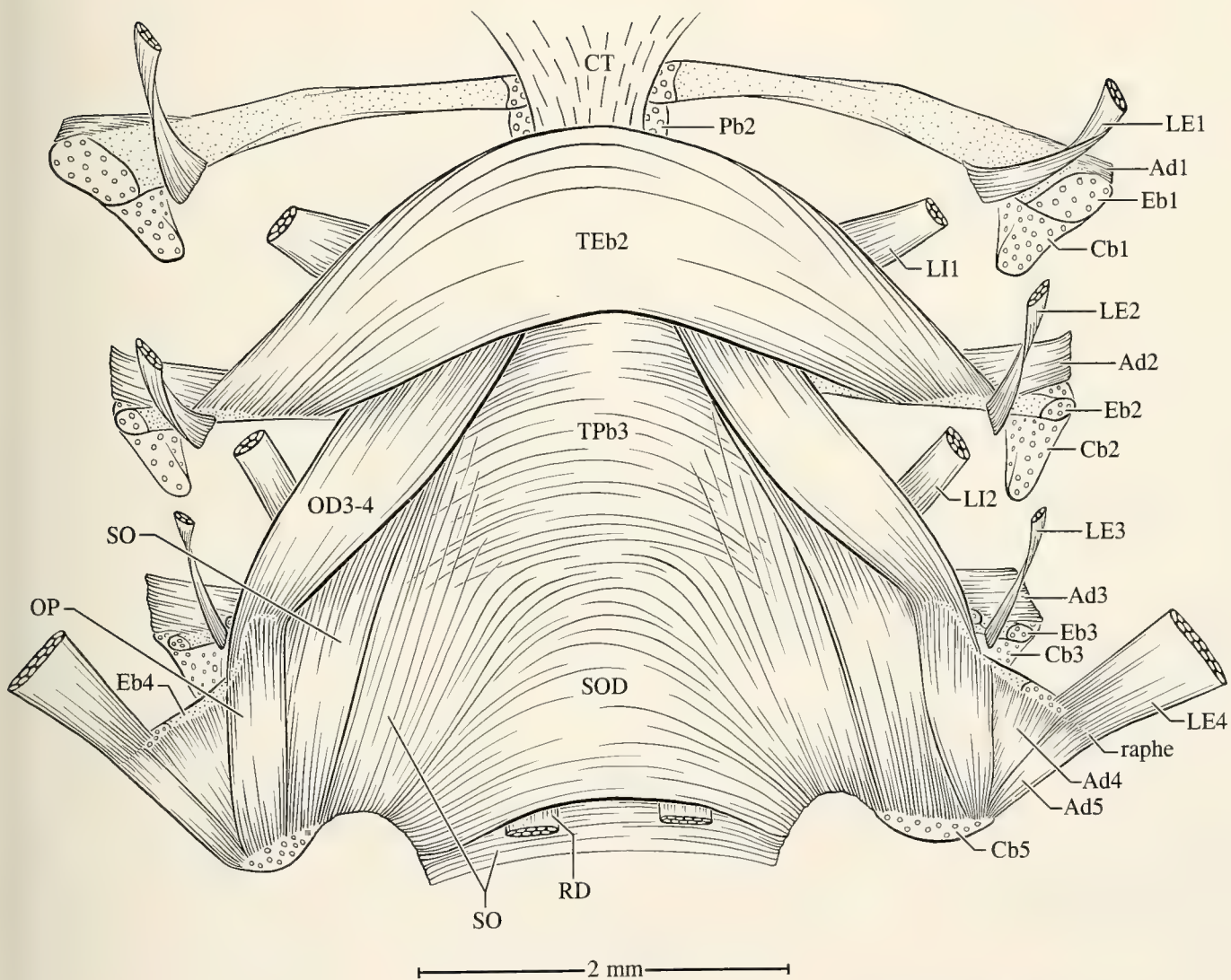




Figure 1 is a detailed anatomical drawing of the ventral view of the head capsule of a male black fly (*Simulium*). The drawing shows various structures labeled with abbreviations: Ad1, LE1, LI1, TEB2, Pb2, OD3-4, Eb2, TEb2, Cb1, Eb1, lig., LE2 insertion, Cb2, Eb2, Pb3 raphe, Pb3, Eb3, LE4, LP, Eb4, RD, SO, OP, Ad5, LP, Ad3, LI2, Ad2, LE2, Ad1, and TPb3-Eb3-Eb4. A scale bar at the bottom indicates 2 mm.

Plate 87. *Gasterosteus aculeatus*, USNM 344603: A, dorsal view, left-side LE4 and right-side LE2 removed (insertion positions indicated by shading), right-side OD3–4 cut away. B, posterior view, right-side reversed; Ad4 and Ad5 obscured from view.





***Hypoptychus***  
(Hypoptychidae)

Plate 88. *Hypoptychus dybowskii*, UW 29655: dorsal view, composite based on three specimens.





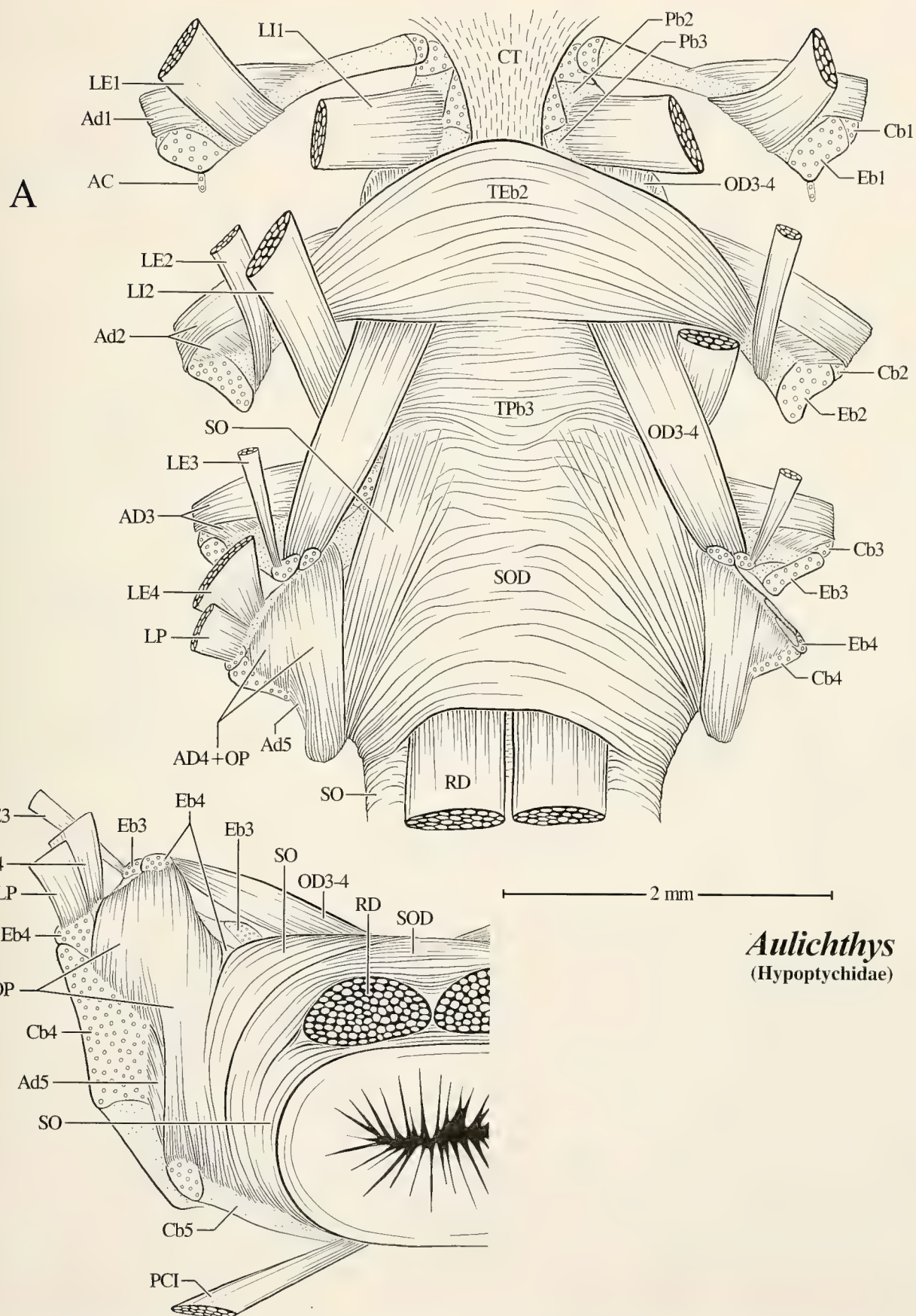
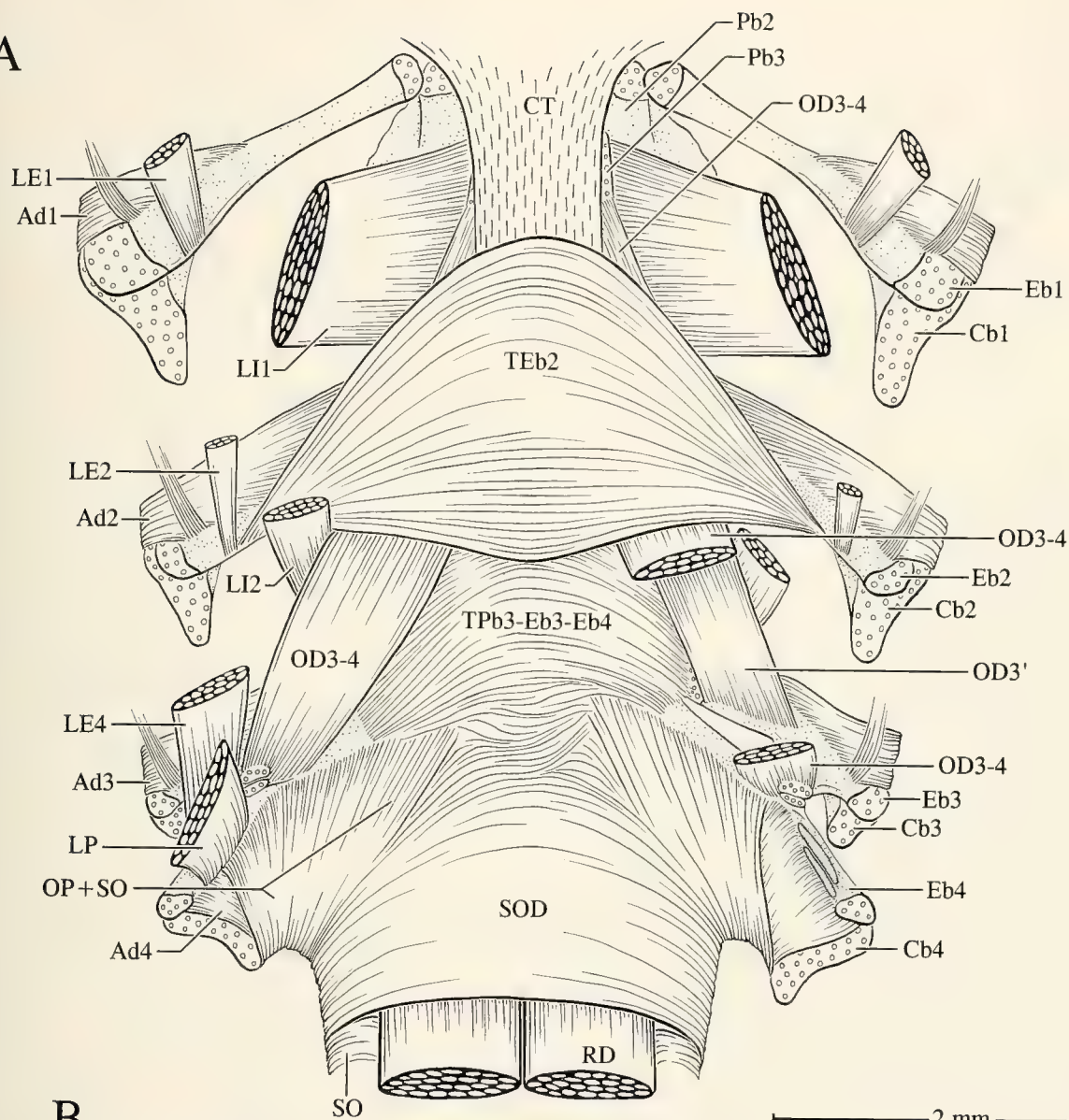


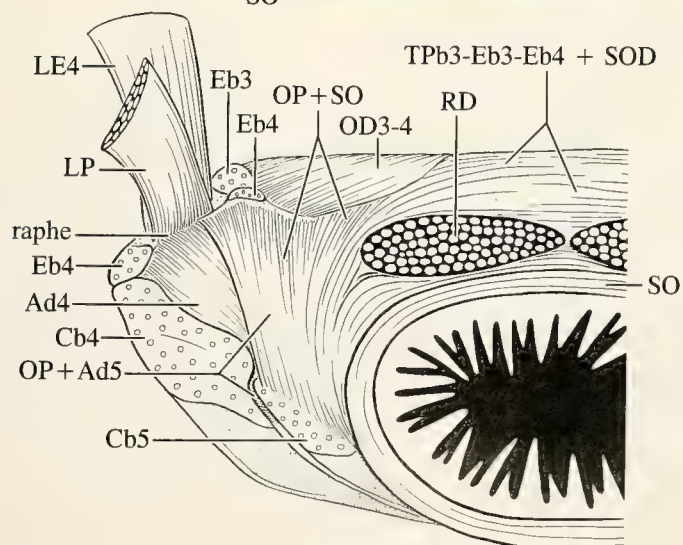
Plate 89. *Aulichthys japonicus*, USNM 347504: A, dorsal view, right-side LE4 and LP removed (insertion positions indicated by shading). B, posterior view, left side.



A



B

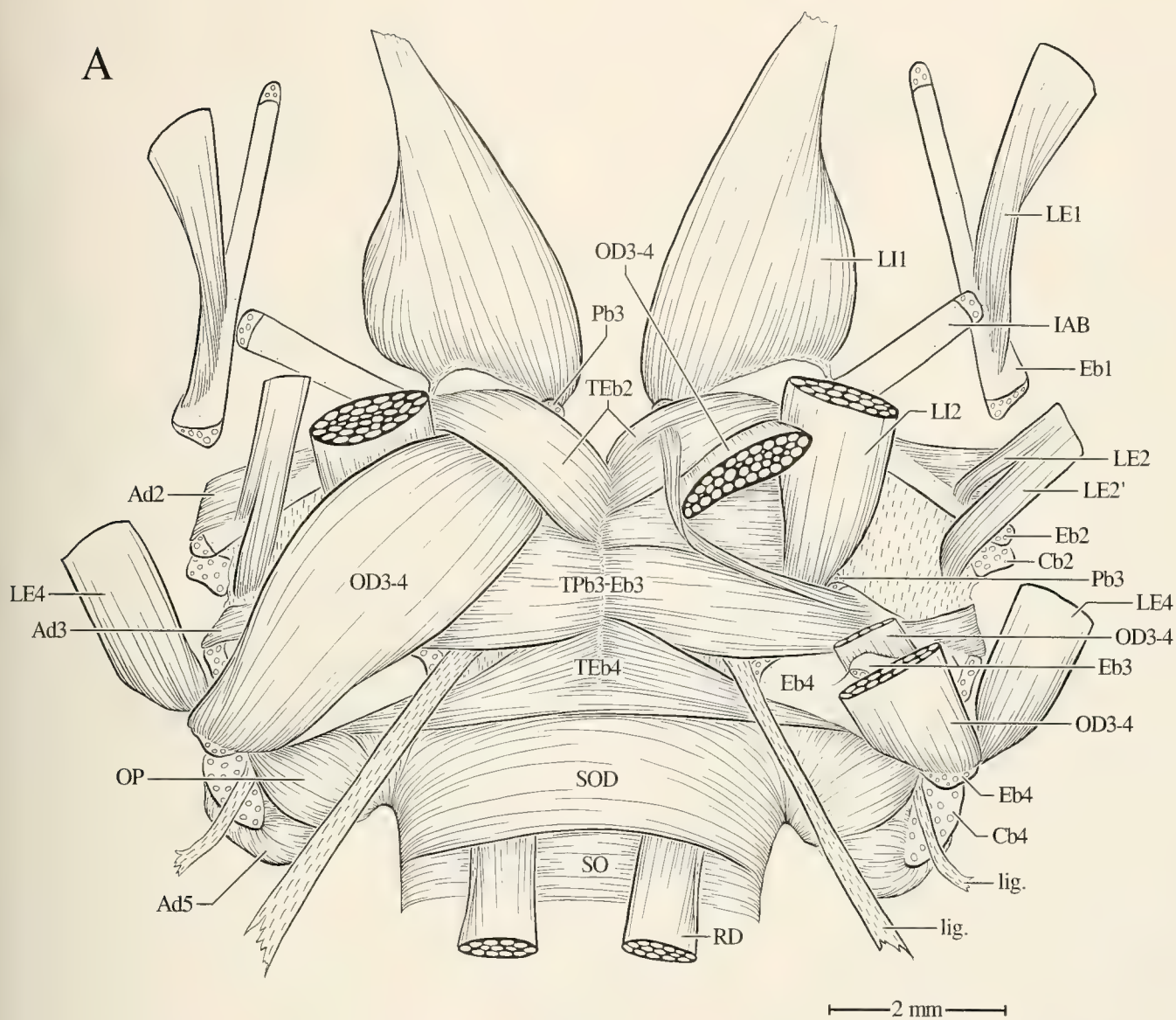


*Aulorhynchus*  
(Aulorhynchidae)

Plate 90. *Aulorhynchus flavidus*, USNM 344688: A, dorsal view, right-side LE4 and LP removed (insertion positions indicated by shading) and OD3-4 bisected to reveal OD3'. B, posterior view, left side.







**Synbranchus**  
(Synbranchidae)

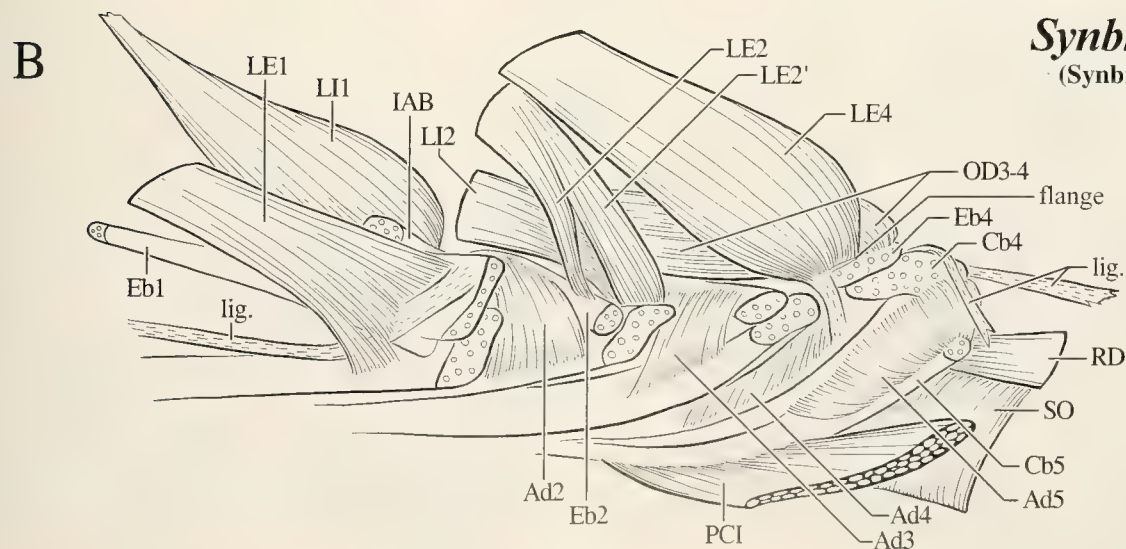


Plate 91. *Synbranchus marmoratus*, USNM 311207: A, dorsal view; right-side OD3-4 bisected; note anomalous TD muscle strand. B, lateral view, left side. Rendition of ligaments should be verified; see additional remarks following descriptive account).



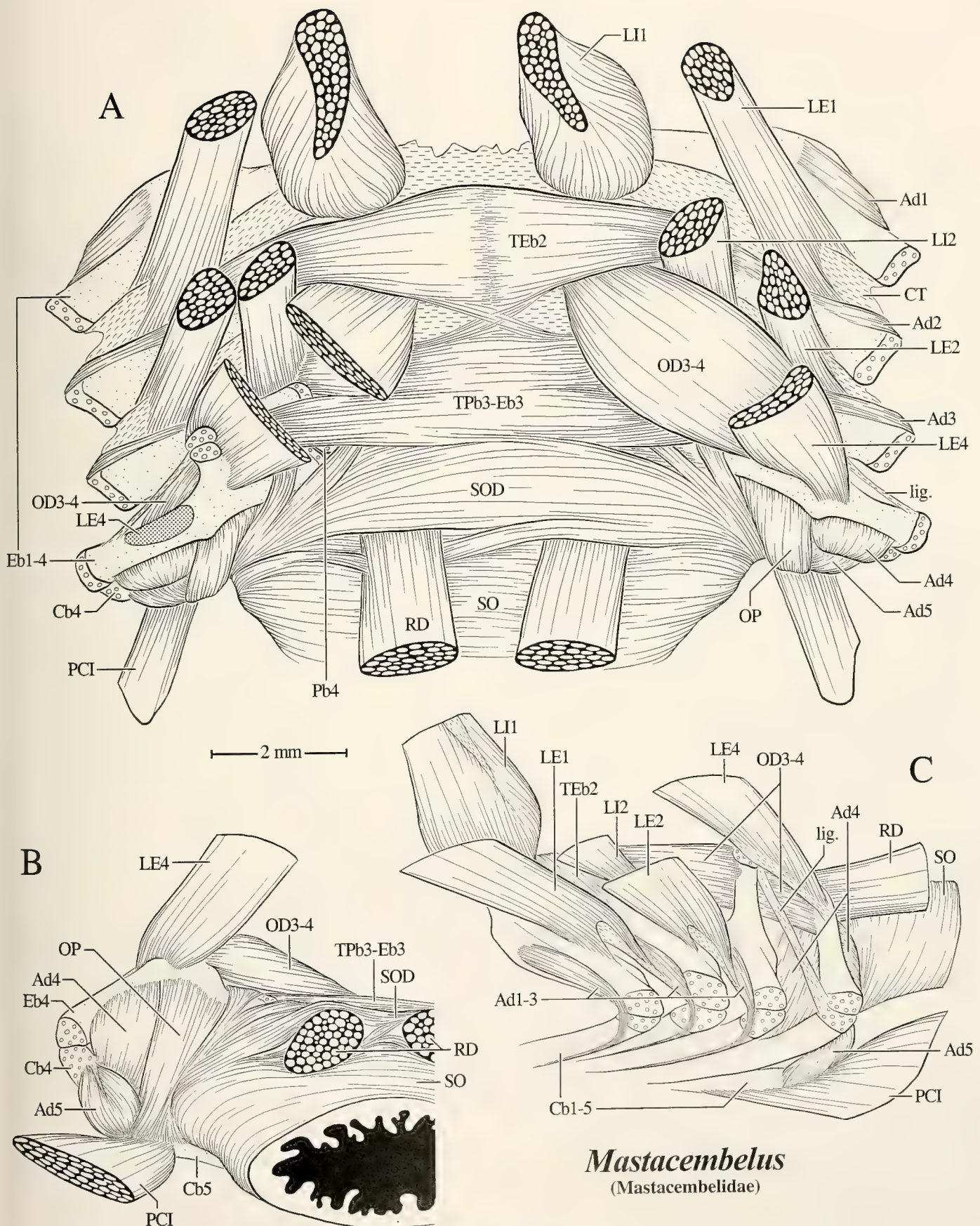
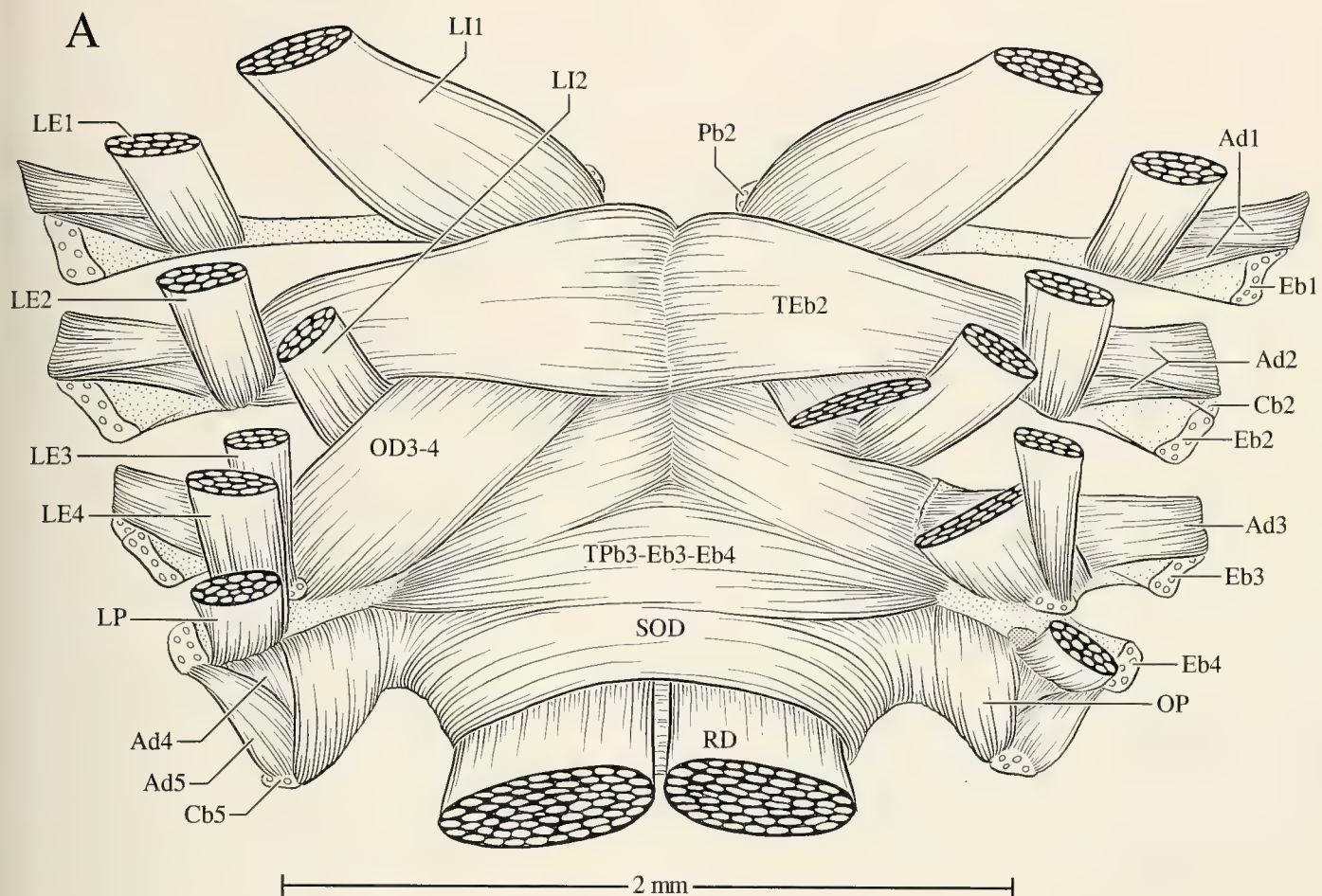


Plate 92. *Mastacembelus armatus*, USNM 319465: A, dorsal view, left-side LE4 removed (insertion position indicated by shading) and OD3-4 bisected. B, posterior view. C, lateral view, right side reversed.







***Elassoma***  
(Elassomatidae)

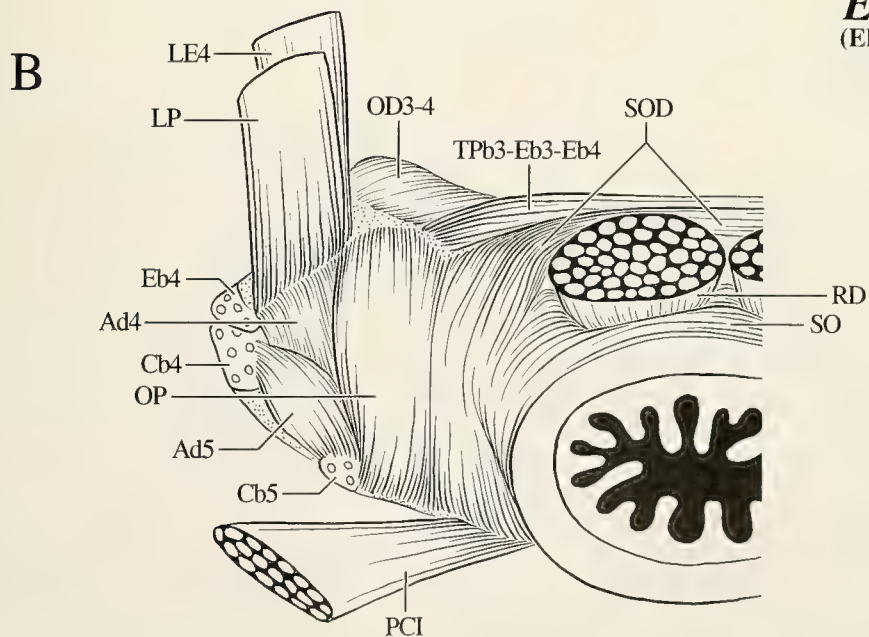


Plate 93. *Elassoma zonatum*, USNM 173343: A, dorsal view, right-side OD3-4 bisected and LE4 removed (insertion position indicated by shading). B, posterior view, left side.



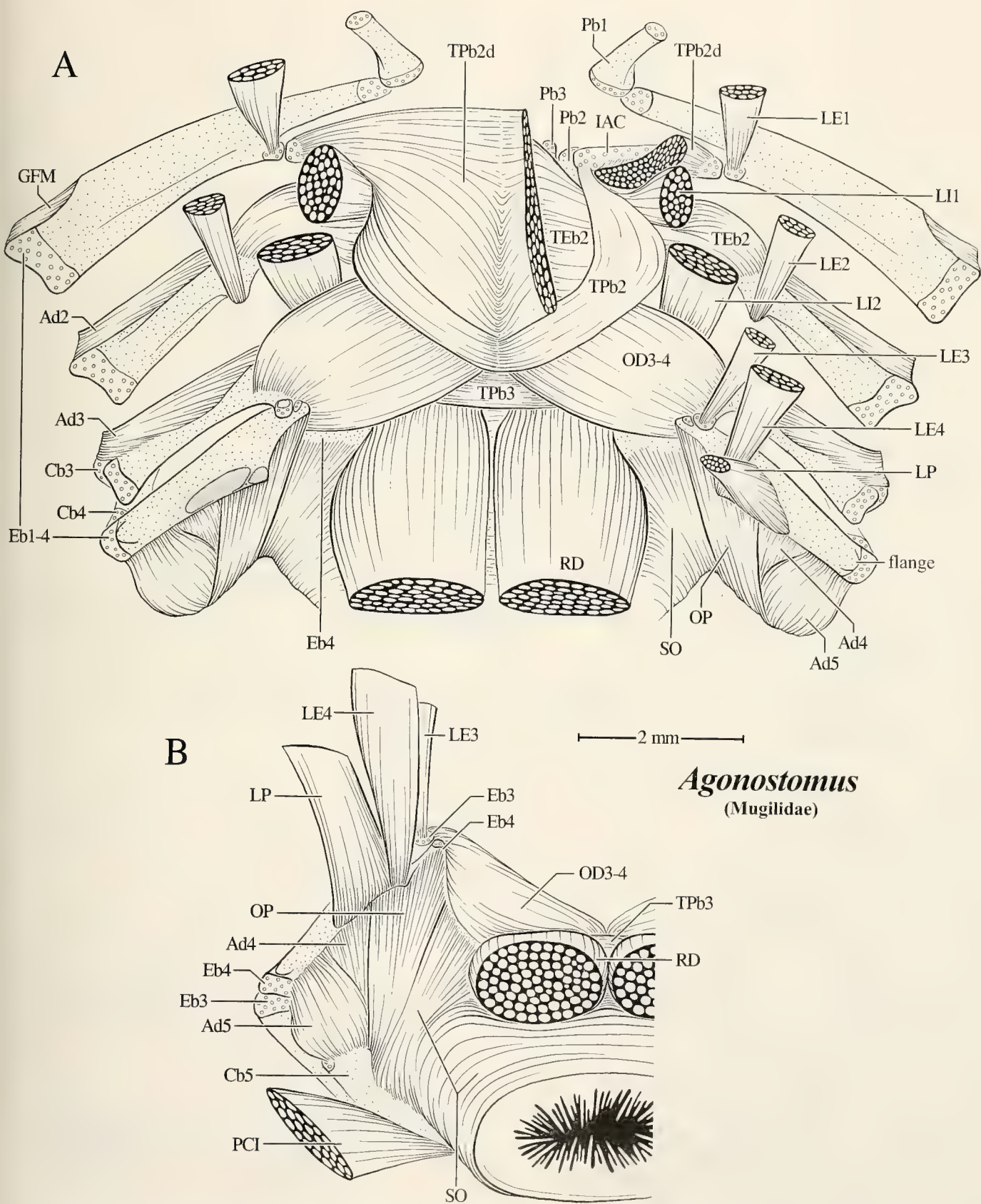
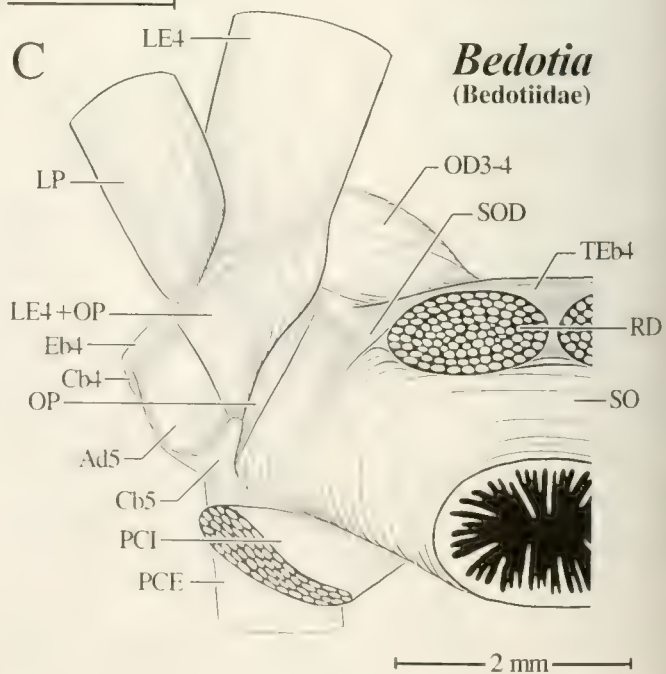
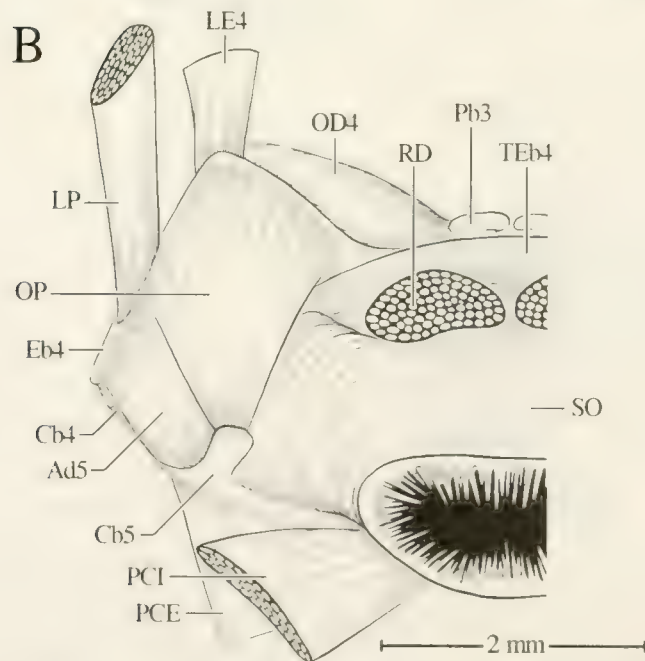
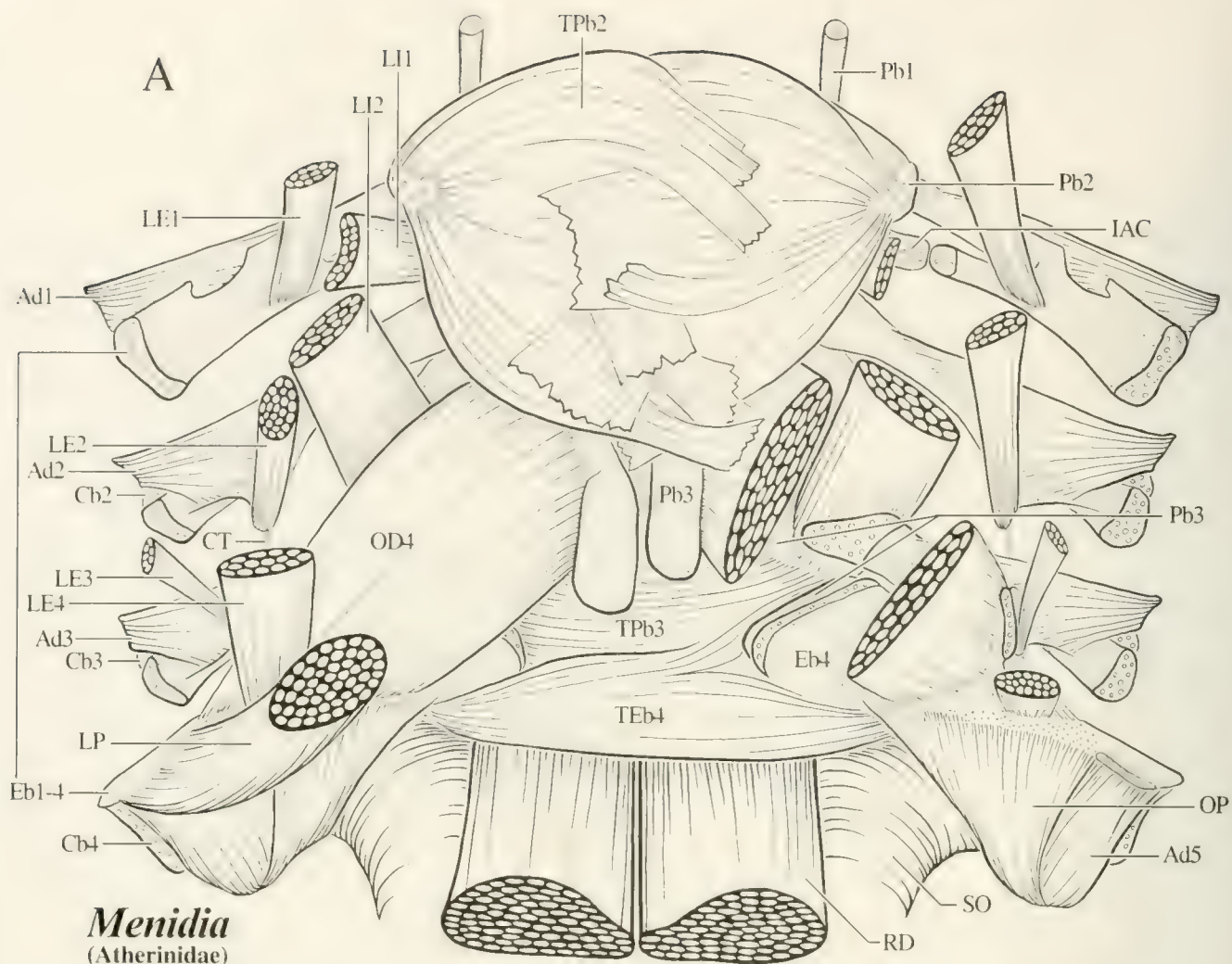


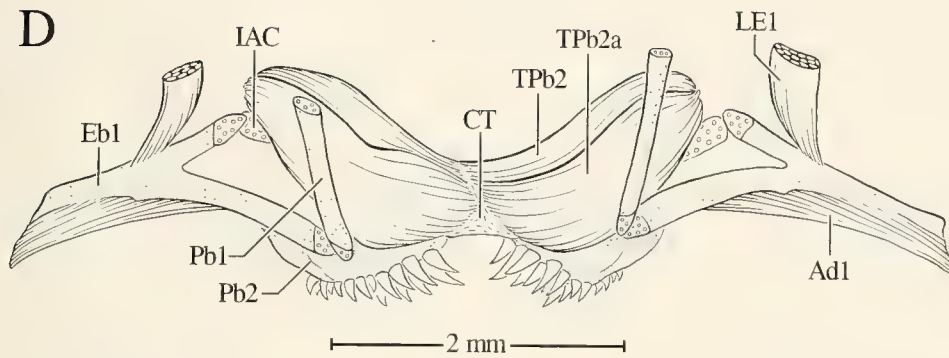
Plate 94. *Agonostomus monticola*, USNM 322336: A, dorsal view, right-side TPb2d bisected to reveal underlying structures; left-side LE3, LE4, and LP removed (insertion positions indicated by shading), all other levators greatly truncated. B, posterior view, right side reversed. Note: SOD present or absent, see description.





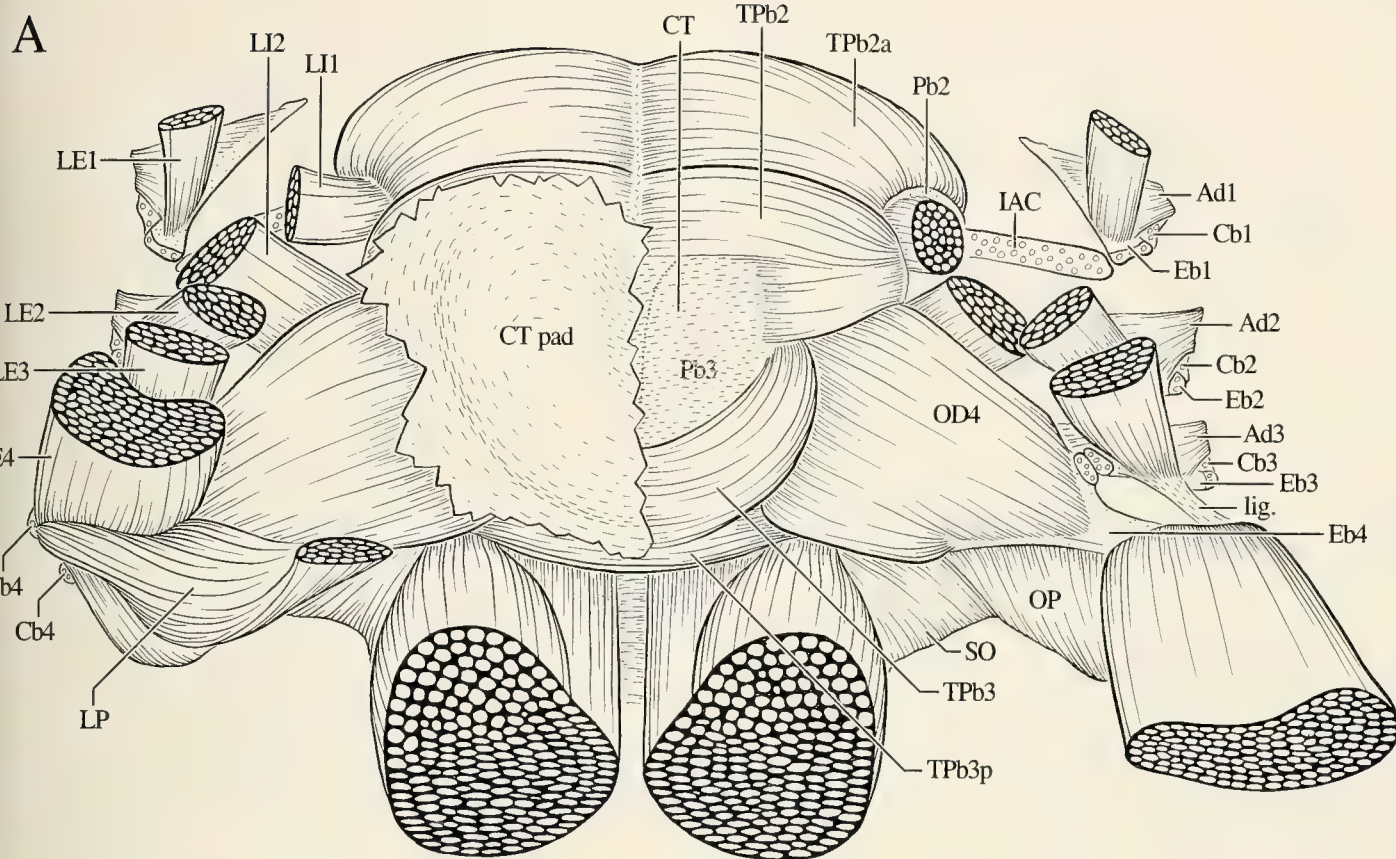
Plates 95.1, 95.2. A, B, D, *Menidia peninsulae*, USNM 160465: A, dorsal view, levators truncated, right-side OD4 cut away, LP removed (insertion indicated by shading), Ad4 present but obscured in all views; CT represents ligament-like thickening of lateral edge of CT roofing pharynx. B, posterior view. LP pushed anteriorly. D, frontal view. C, *Bedotia* species, USNM 301513: posterior view, LP rotated clockwise.

D

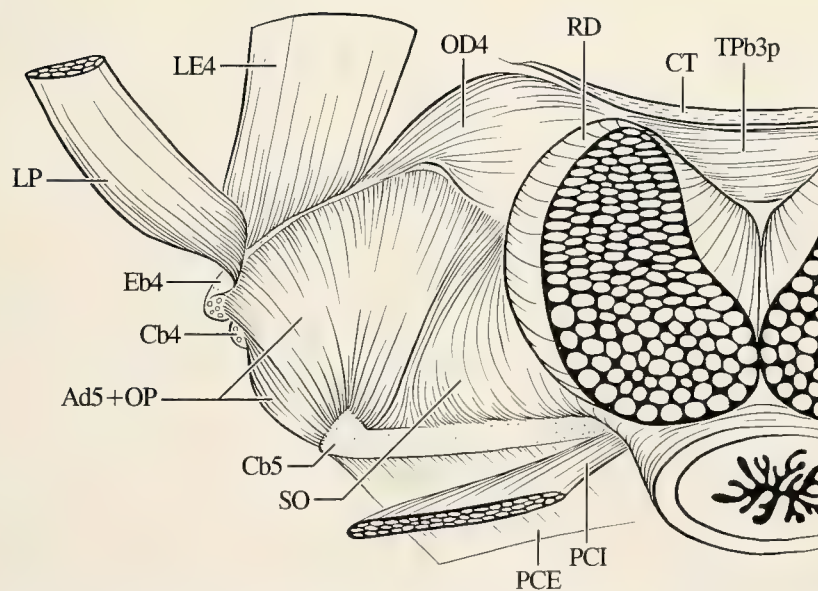


*Menidia*





**B**

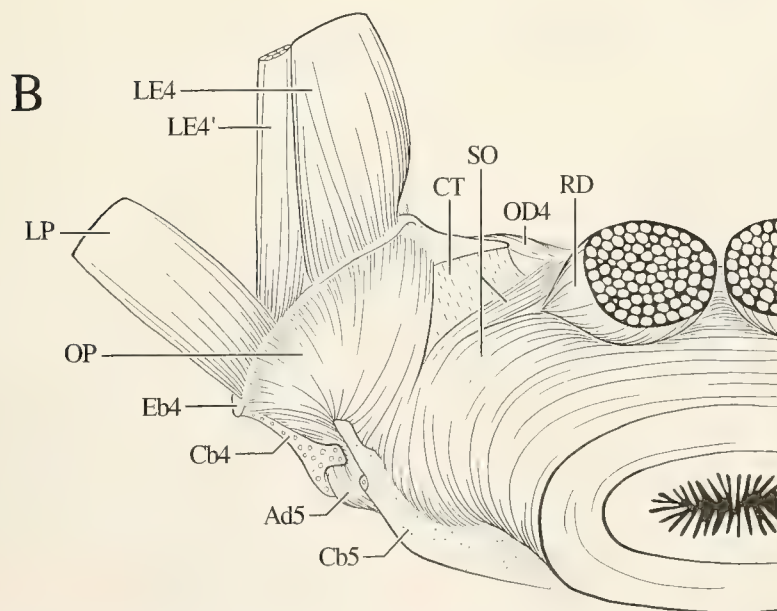
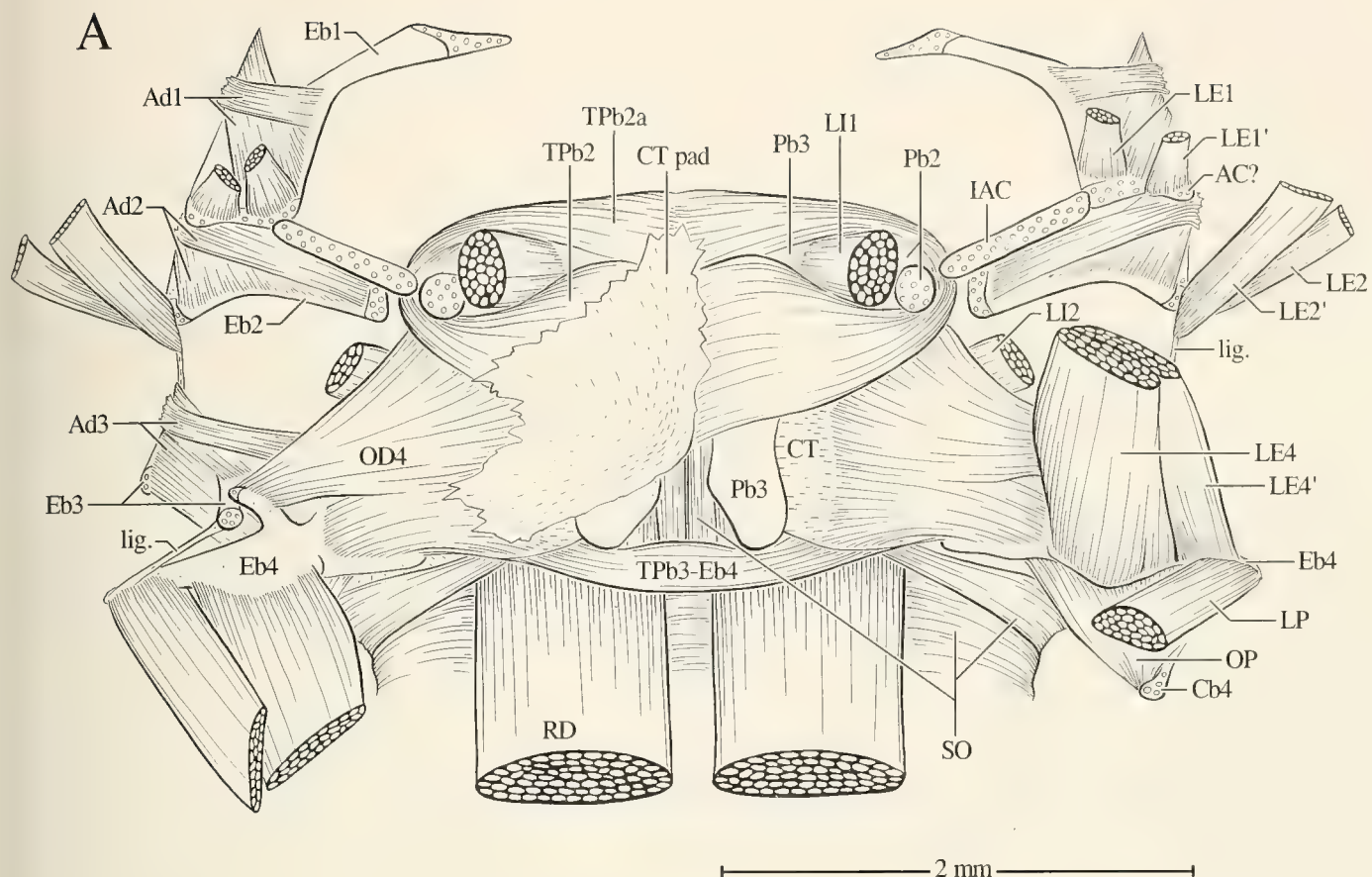


***Rivulus***  
(Aplocheilidae)

Plate 96. *Rivulus marmoratus*, USNM 293487: A, dorsal view, right-side dorsalmost CT cut away to expose CT covering Pb3 articulating facet (medial edge of facet indicated by dotted line), right-side LE4 and LP retracted (LP becomes hidden) to reveal LE3 insertion on Eb3 and ligament extending between Eb3 and Eb4. B, posterior view, LP rotated clockwise to reveal underlying muscles.







*Cyprinodon*  
(Cyprinodontidae)

Plate 97. *Cyprinodon variegatus*, USNM 107023: A, dorsal view, right-side of CT pad removed; left-side LE4' and LE4 pulled posteriorly to reveal underlying muscle attachments and ligament; LE2' inserts on ligament extending from Eb2 to Cb3; LI1 inserts on Pb3. B, posterior view, right side reversed, LP rotated clockwise.



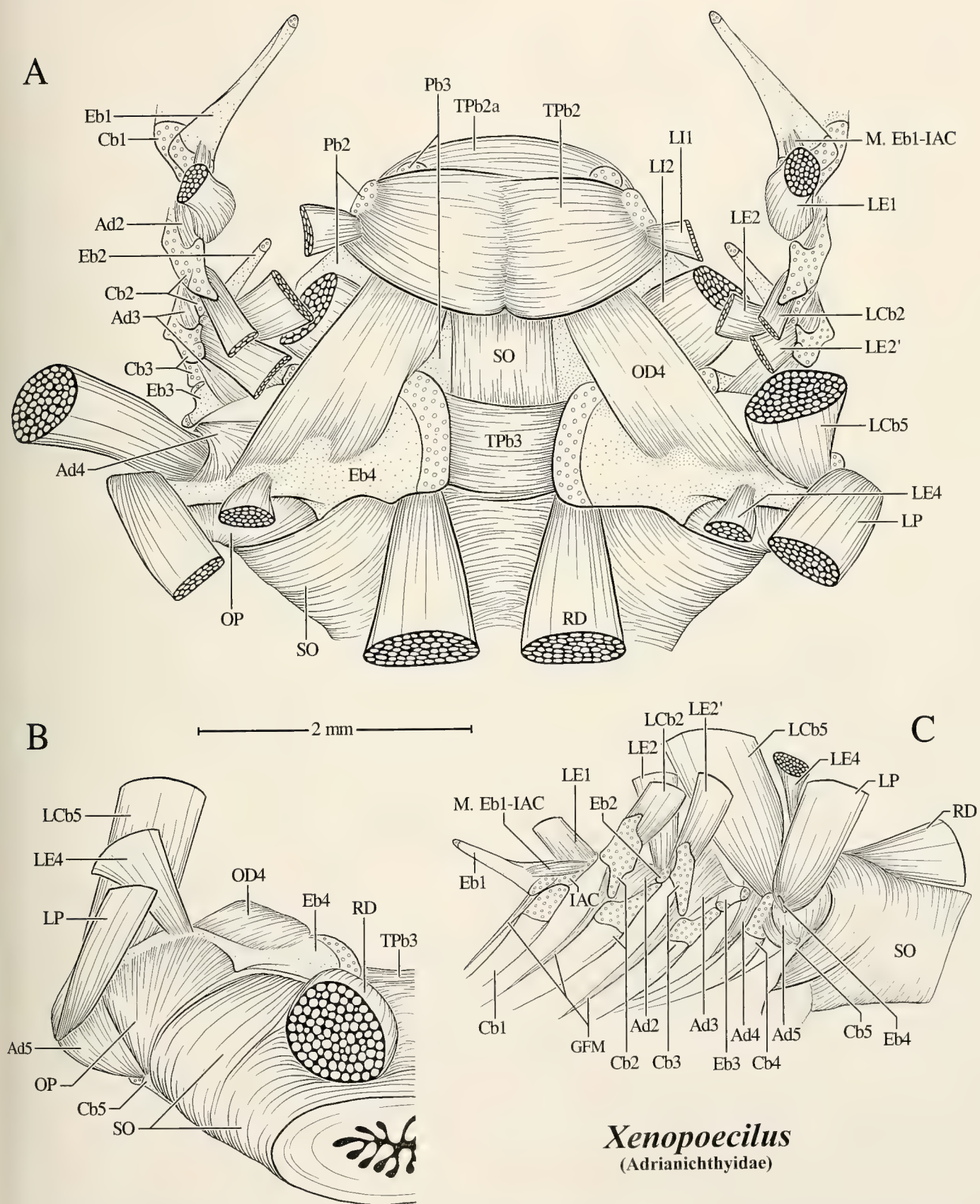


Plate 98. *Xenopoecilus oophorus*, USNM 340431: A, dorsal view, left-side LCb5 rotated laterally, GFMs removed, IAC obscured from view by LE1. B, posterior view, left side. C, lateral view, left side, LP rotated clockwise, Eb3 released from distal end of Cb4.





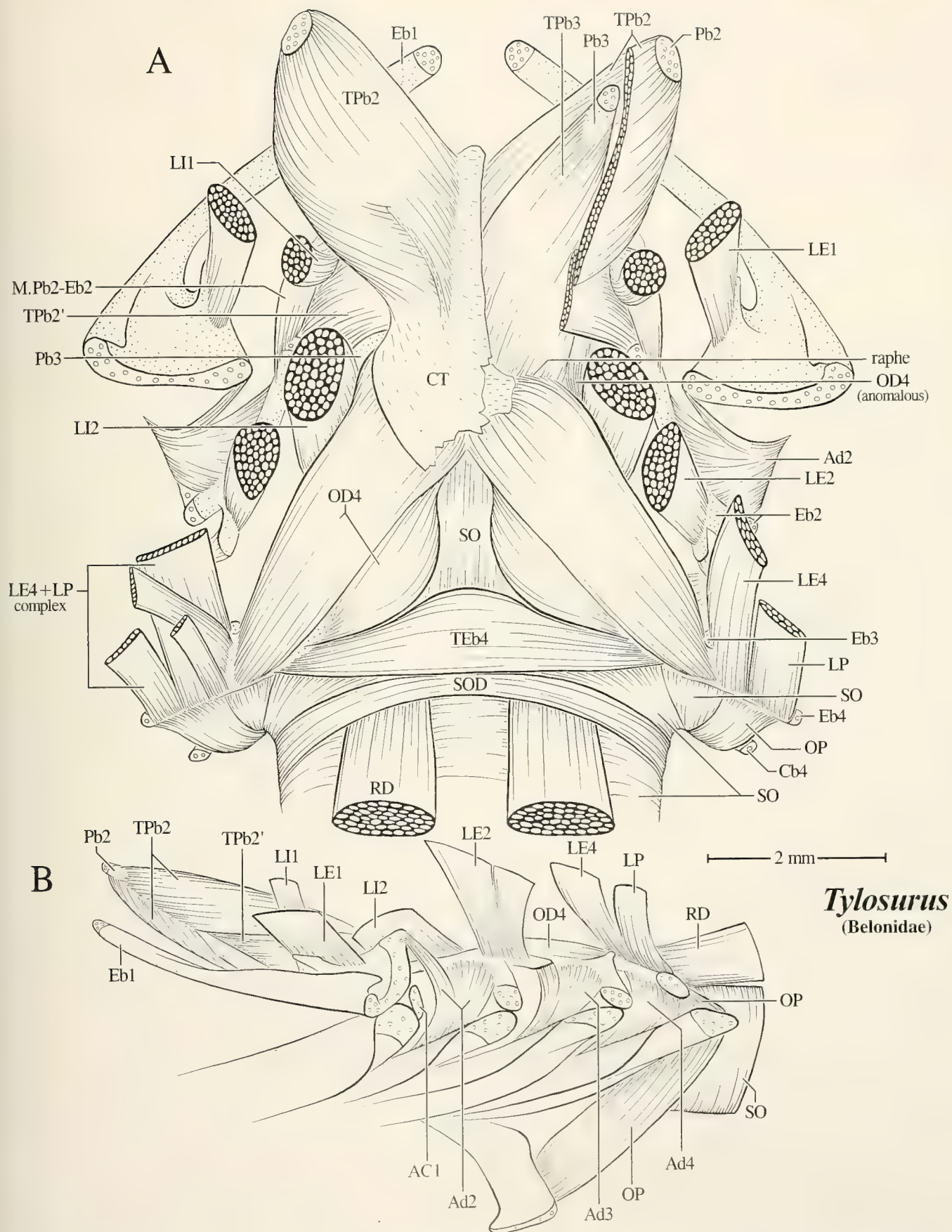
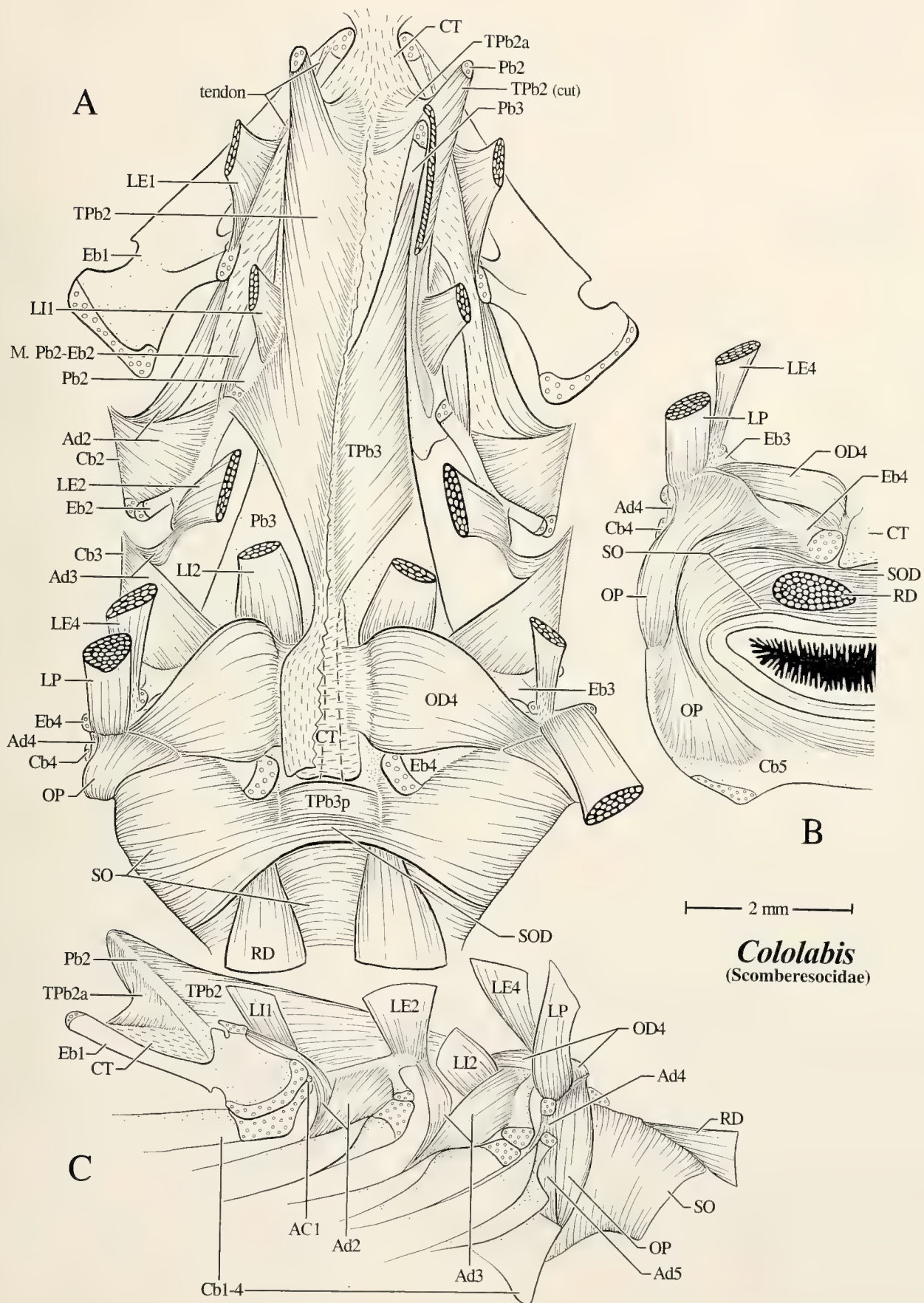


Plate 99. *Tylosurus crocodilus*, composite, mostly from USNM 128454: A, dorsal view, right-side TPb2 and TPb2' cut away to reveal TPb3, LE4-LP complex aberrant. B, lateral view, right side reversed. Eb4 flange present, but unapparent. See description of OP in species account for questionable interpretation of Ad5 and OP.

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Plate 100. *Cololabis saira*, USNM 320999: A, dorsal view, right-side TPb2 cut away to reveal Pb3 and TPb3a (TPb2 attachment area shown in gray on Pb2), dorsal CT layer overlying Pb3 articulating facets cut away on right side to reveal ventral CT layer and attachments of OD4 and TPb3a (medial edges of Pb3 facets shown by dashed lines), right-side LP pulled posteriorly to reveal LE4 insertion (note: LE1 inserts on tendon extending from medial tip of Eb1 to tip of uncinat process). B, posterior view, left side. C, lateral view, left side, LE1 and Eb1 tendon removed. (Identification of OP and Ad5 problematic).

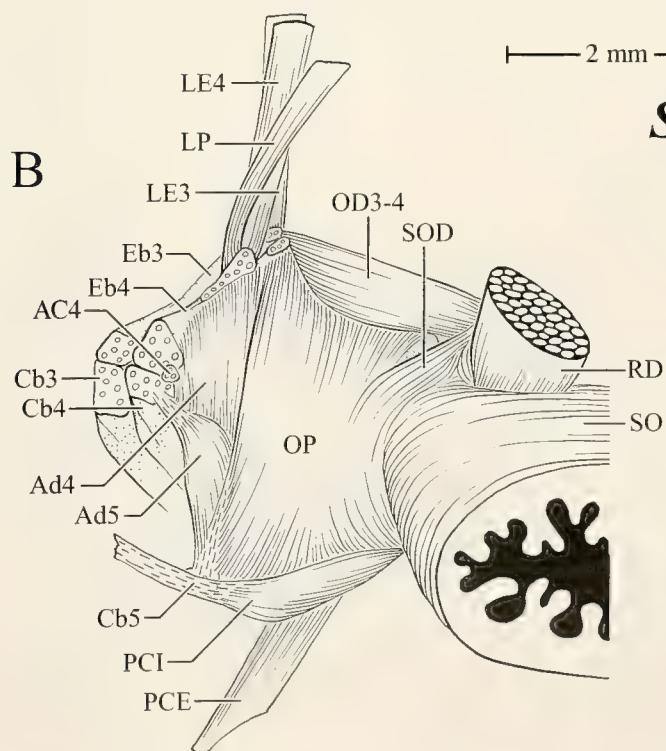
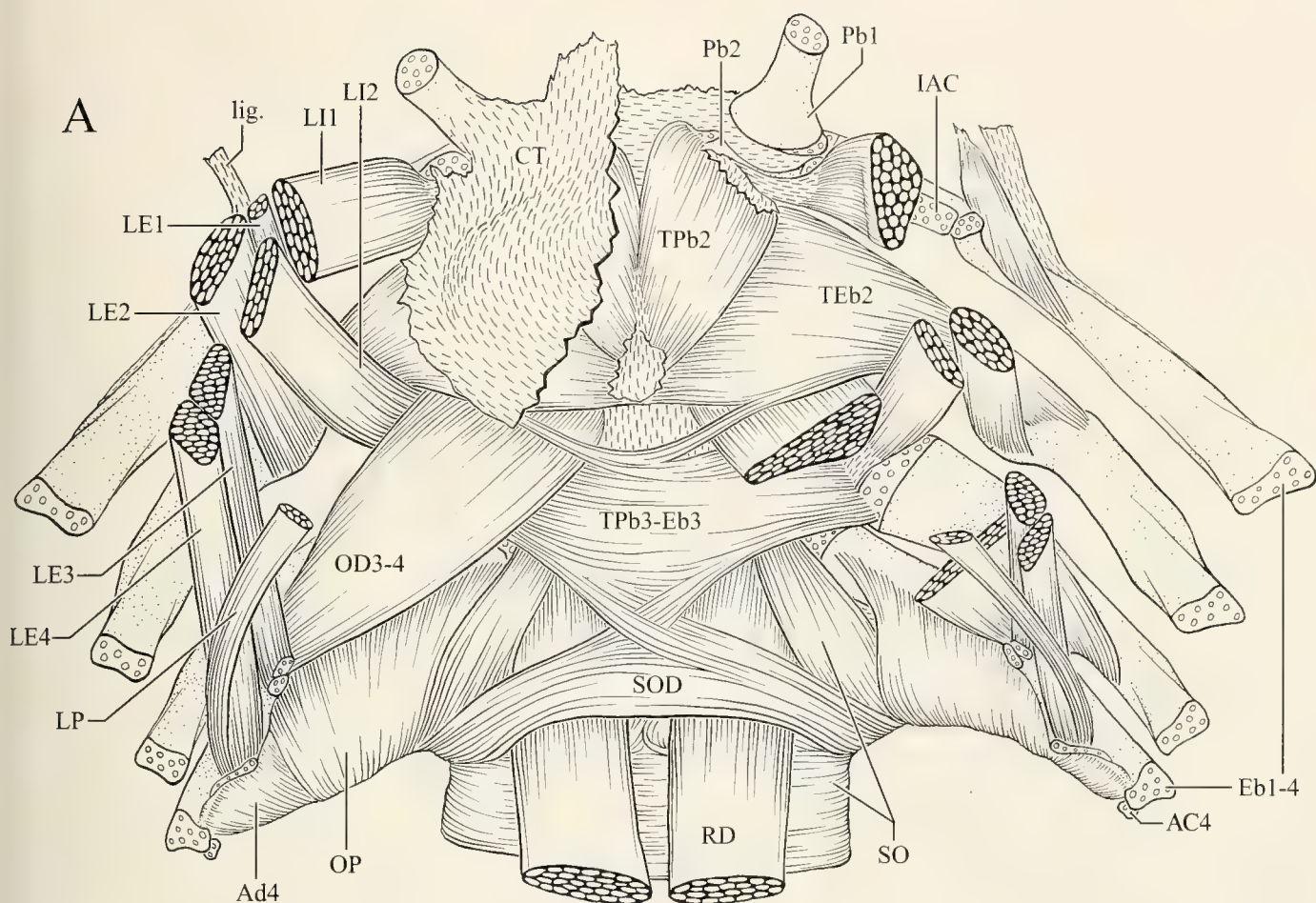












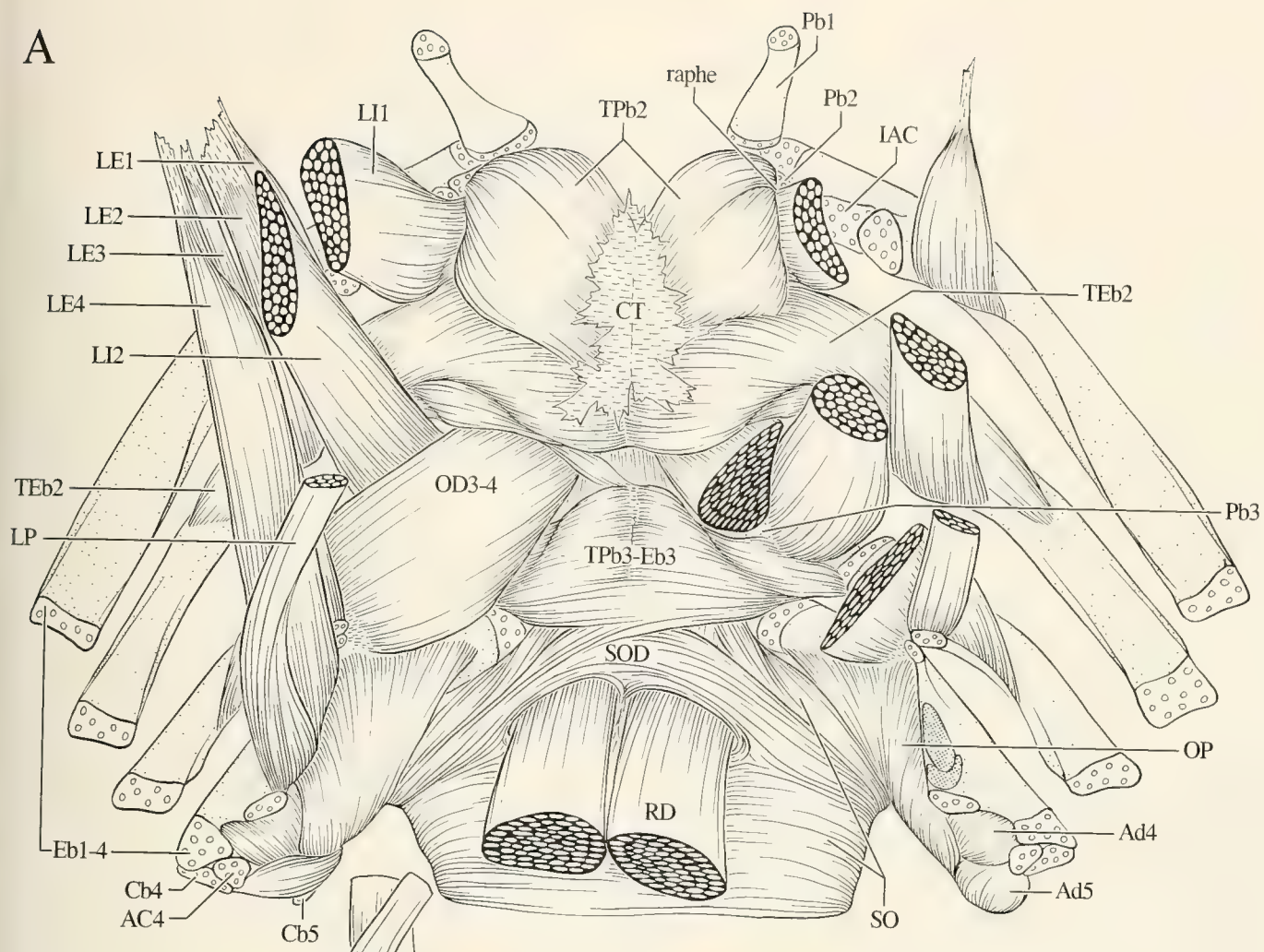
***Synagrops***  
(Acropomatidae)

Plate 102. *Synagrops bellus*, USNM 359306: A, dorsal view, right-side CT removed, OD3-4 bisected; B, posterior view, right side reversed.

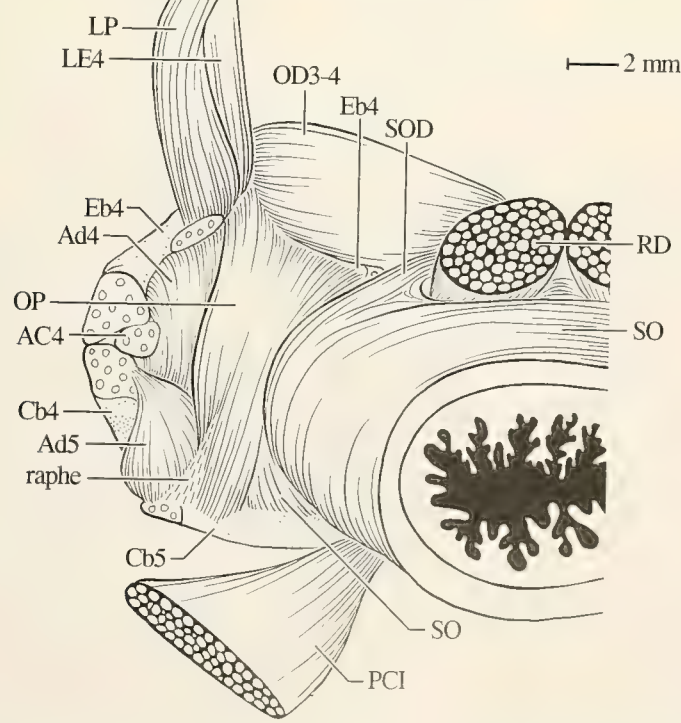




A



B



*Macquaria*  
(Percichthyidae)

Plate 103. *Macquaria colonorum*, USNM 59968: A, dorsal view, dorsal CT trimmed, right-side OD3-4 cut away and LE4 and LP removed (insertion positions indicated by shading). B, posterior view, right side reversed.



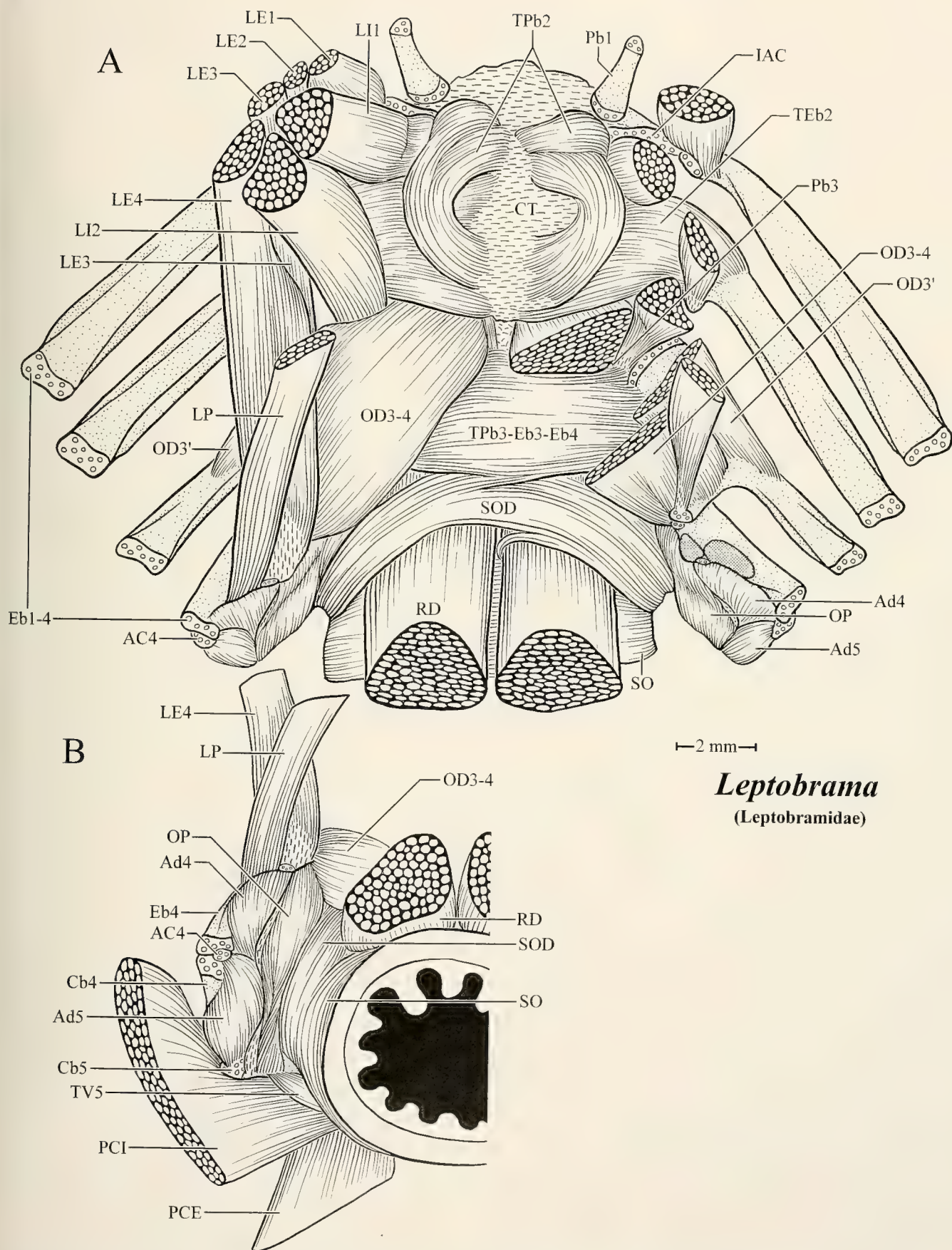


Plate 104. *Leptobrama muelleri*, WAM P556-001: A, dorsal view, right-side OD3-4, 3' bisected, LE4 and LP removed (insertion positions indicated by shading). B, posterior view, left side.





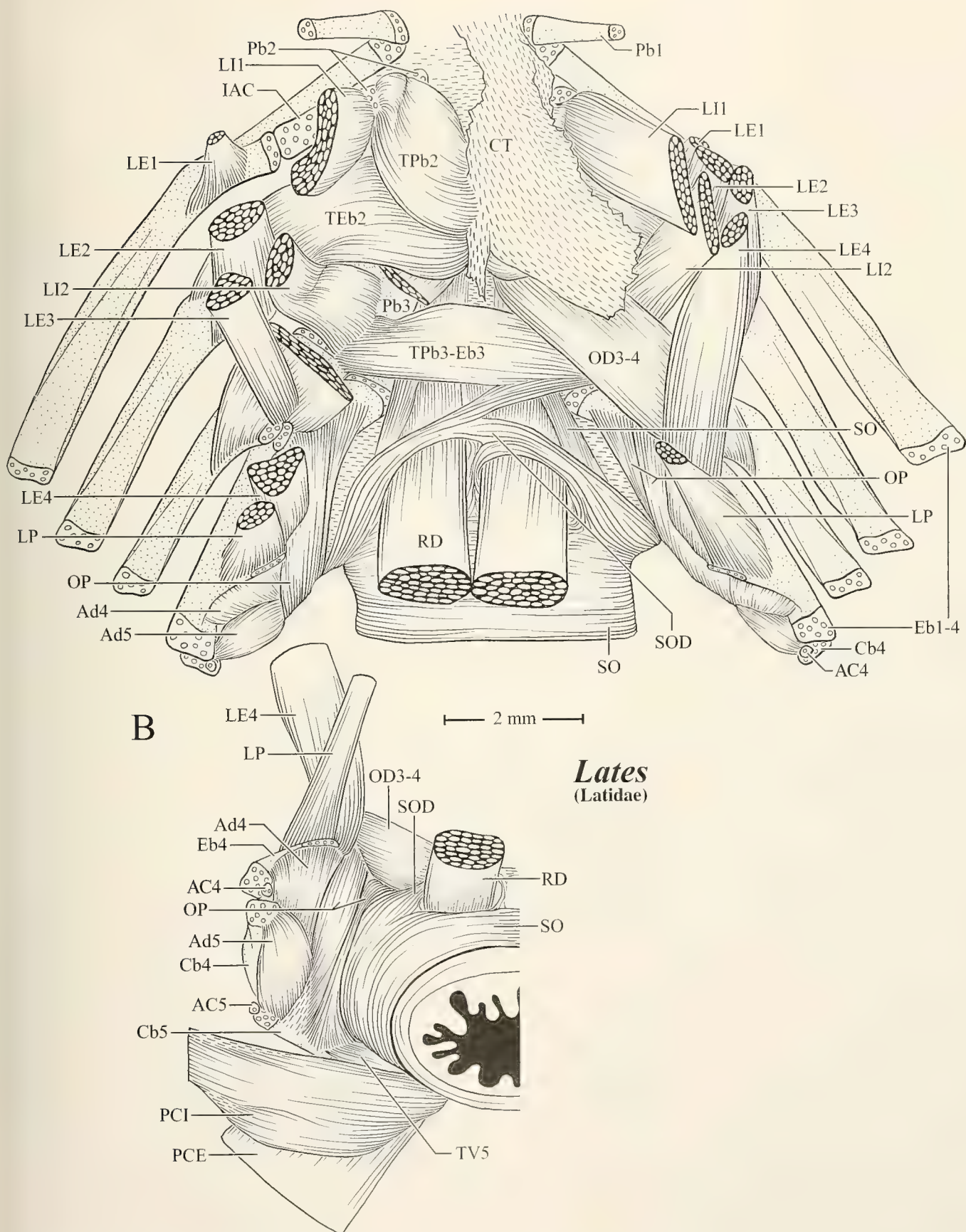
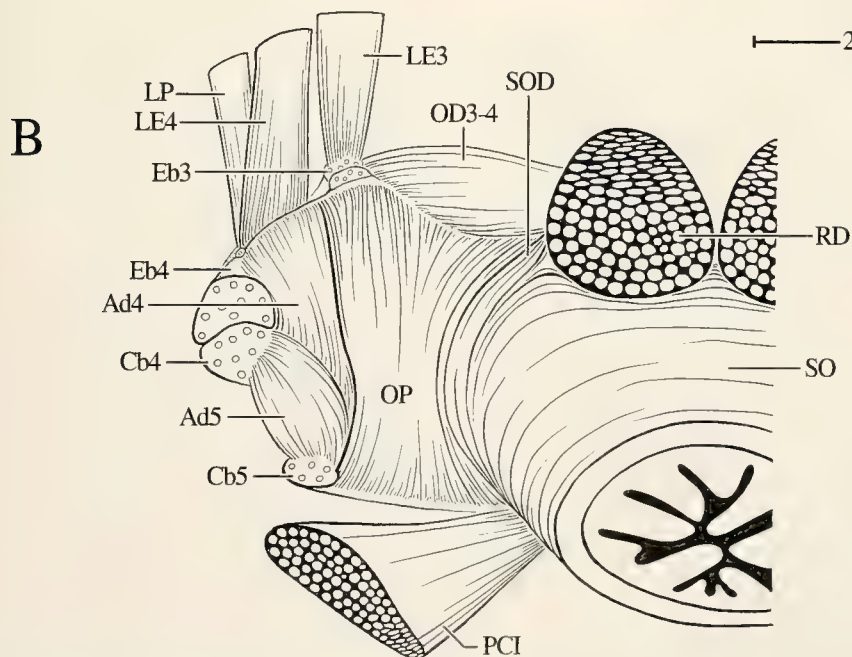
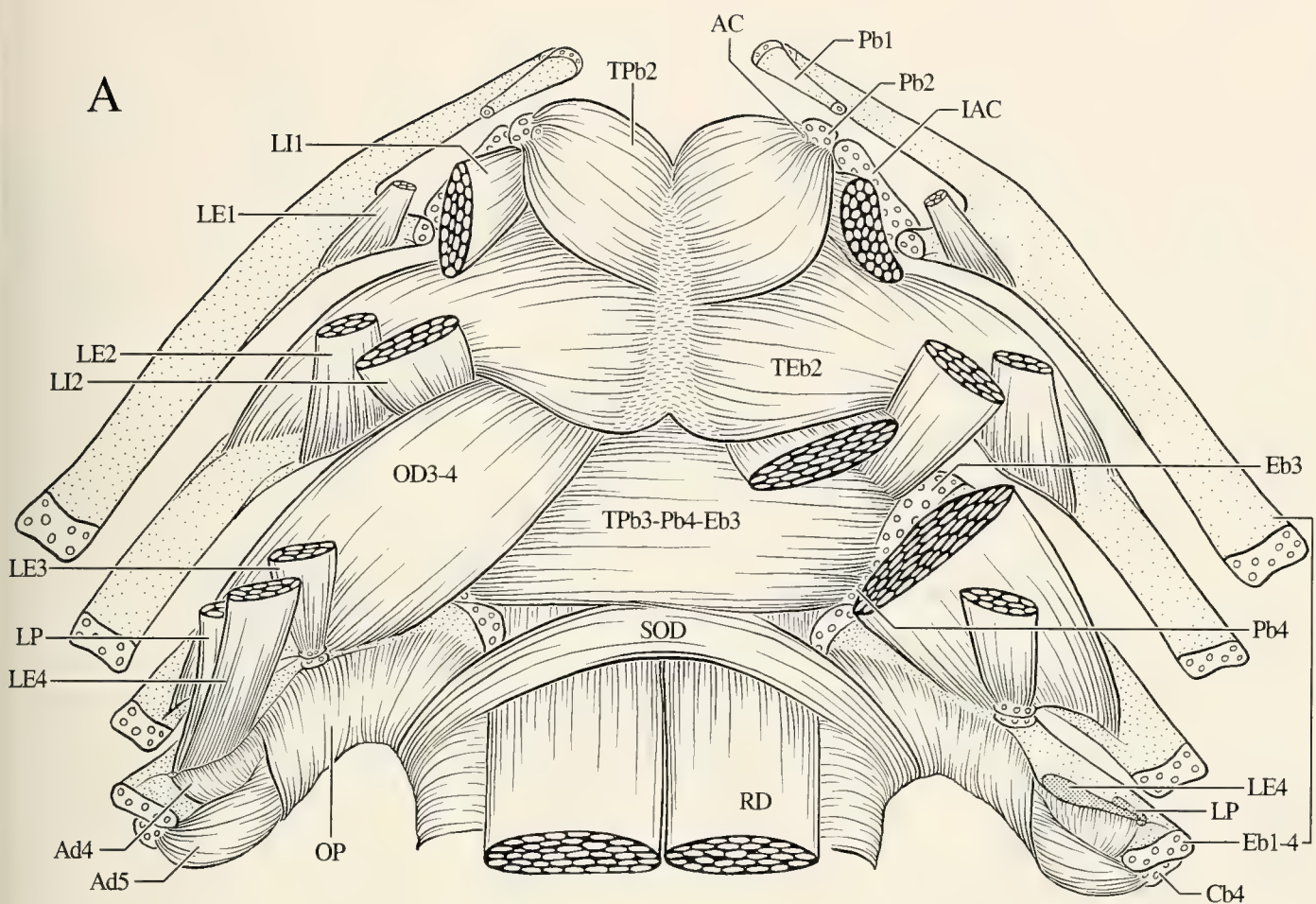


Plate 105. *Lates niloticus*, USNM 332870: A, dorsal view, left-side OD3-4 bisected, CT covering TDA removed. B, posterior view, right side reversed.



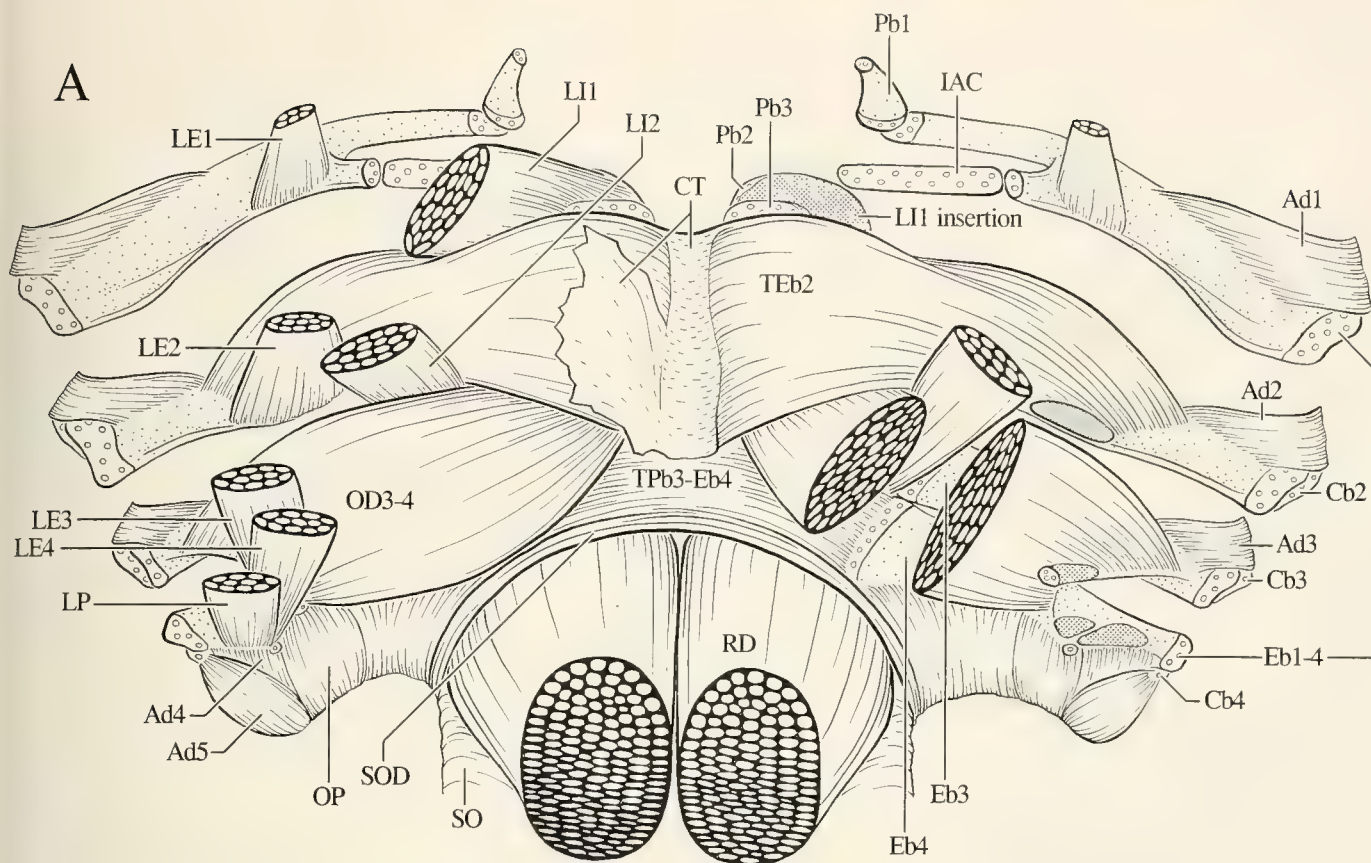


***Micropterus***  
(Centrarchidae)

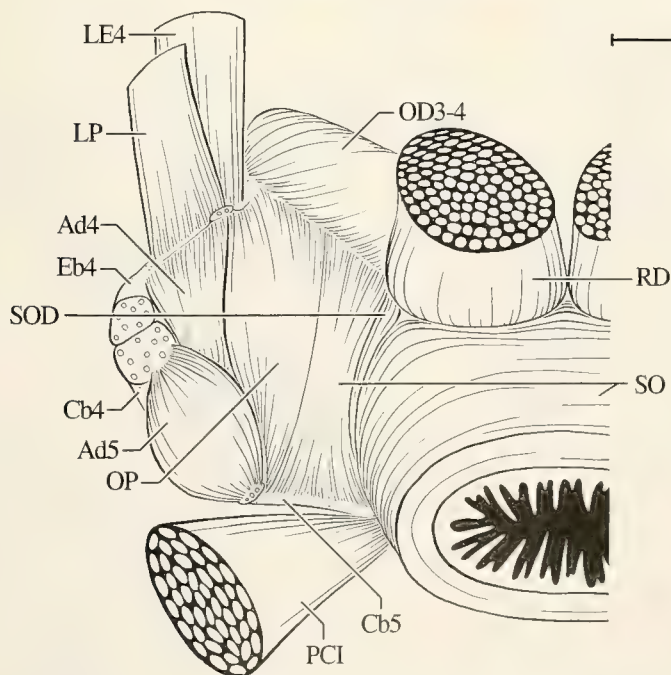
Plate 106. *Micropterus dolomieu*, USNM 332992: A, dorsal view, right-side OD3-4 bisected, LE4 and LP removed (insertions indicated by shading). B, posterior view, left side.







B



*Enneacanthus*  
(Centrarchidae)

Plate 107. *Enneacanthus gloriosus*, USNM 243828: A, dorsal view, right-side OD bisected and LI1, LE2, LE3, LE4, and LP removed (insertion positions indicated by shading), size of LI1 exaggerated relative to size of LI2. B, posterior view, left side.



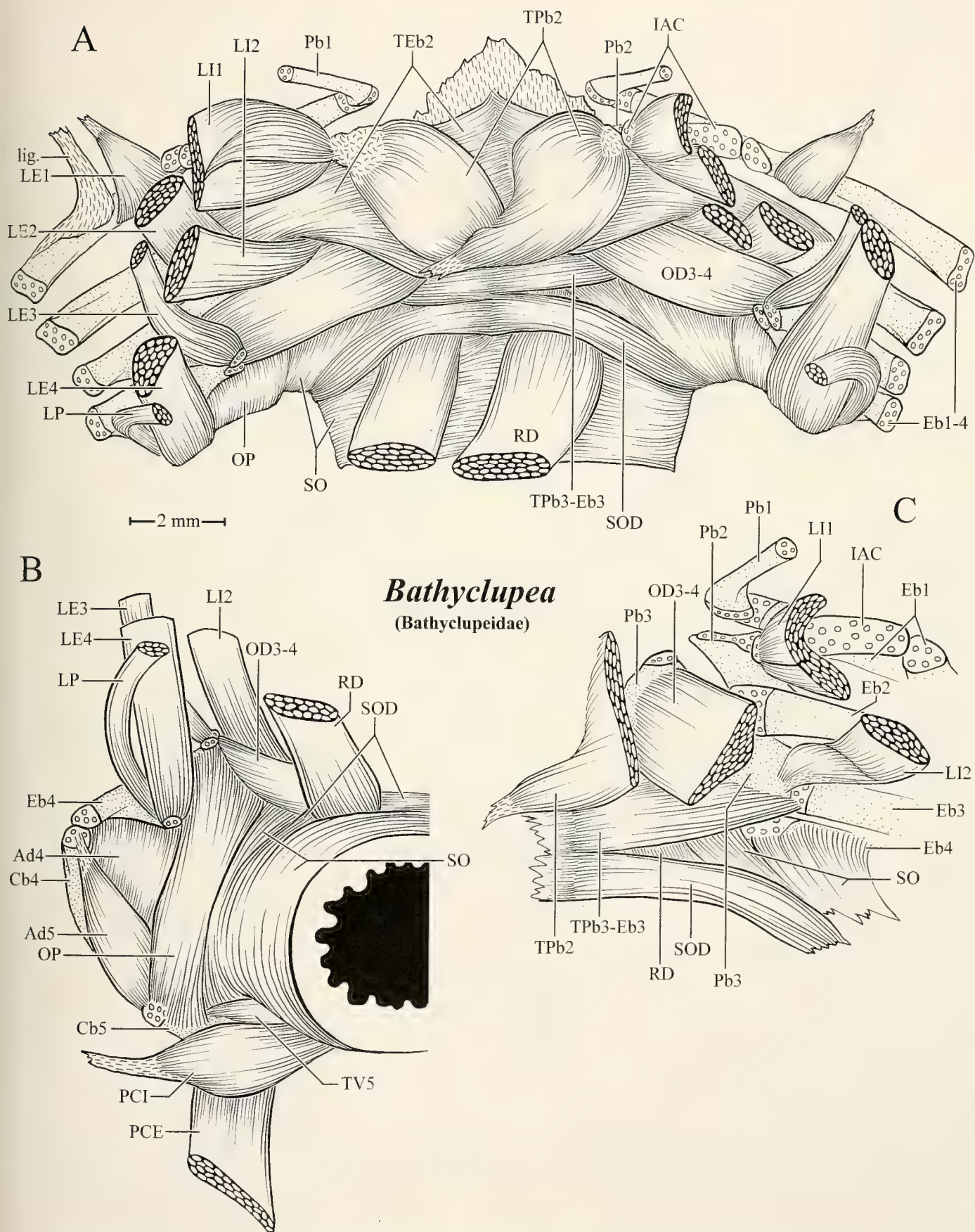


Plate 108. *Bathyclupea argentea*, USNM 372712: A, dorsal view: LE1s pivoted anteriorly from insertions; right-side LI1, LI2, LE2 greatly truncated; CT attaching LI1 insertion to Pb2 removed. B, posterior view, left side. C, dorsoanterior view, right side to show muscle attachments obscured in A; TPb2 and OD3-4 cut away laterally; TEb2, LE2, and CT joining LI1 to Pb2 removed.





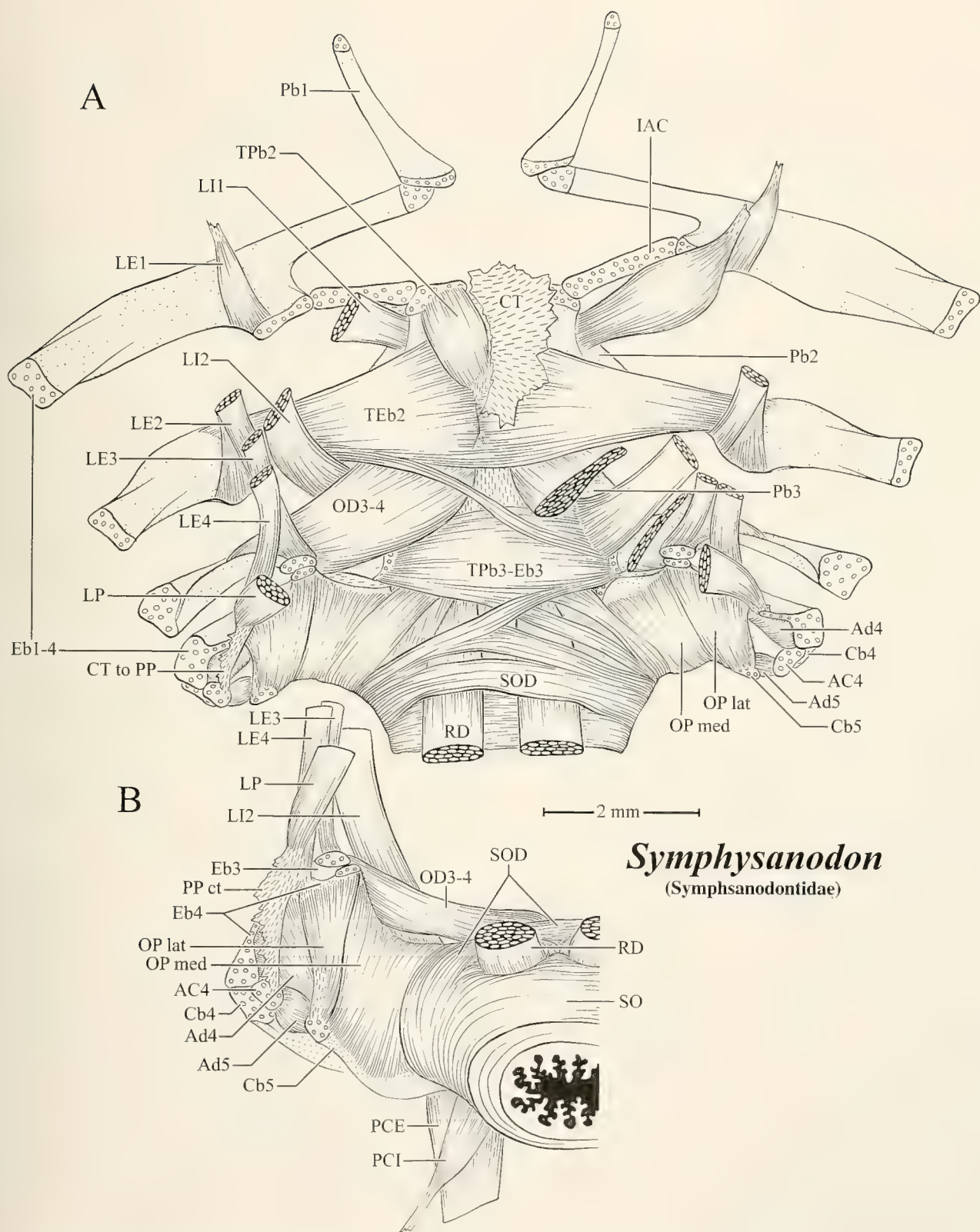


Plate 109. *Symphysanodon berryi*, USNM 370558: A, dorsal view, Pb1s pivoted anteriorly; left-side CT sheets removed; CT of PP partially indicated (does not attach to AC4); right-side OD3-4 bisected, CT of PP removed. B, left side, posterior view.



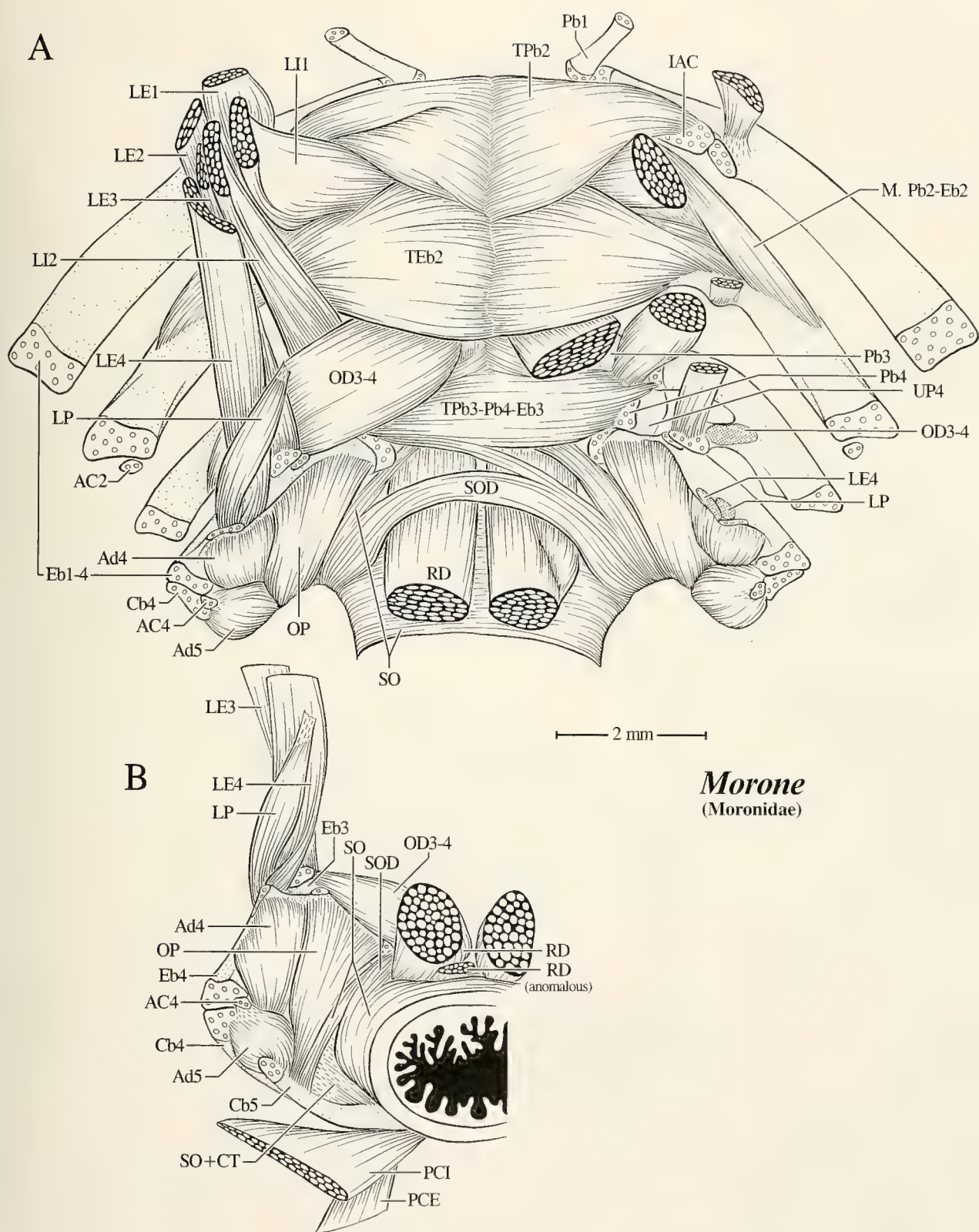
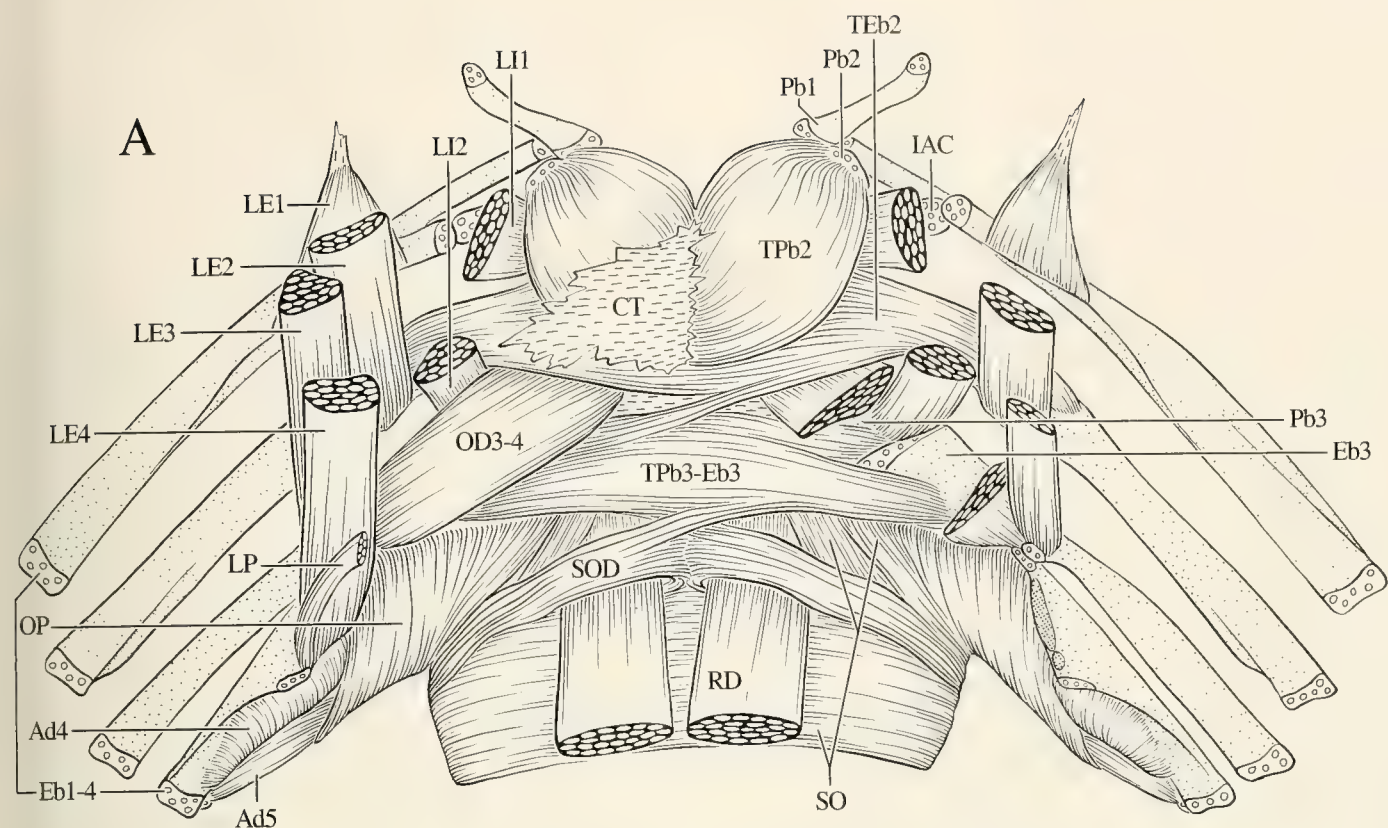


Plate 110. *Morone americana*, USNM 61612: A, dorsal view, right side OD3-4 cut away and LE4 and LP removed (insertions indicated by shading). B, posterior view, left side.







— 2 mm —

***Epinephelus***  
(Serranidae)

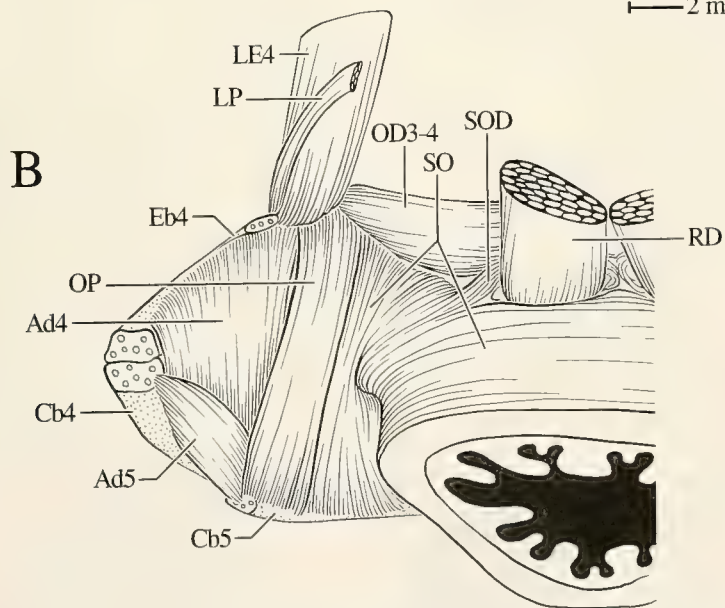


Plate 111. *Epinephelus merra*, USNM 318074: A, dorsal view, right-side OD3-4 cut away and LE4 and LP removed (insertions indicated by shading). B, posterior view.



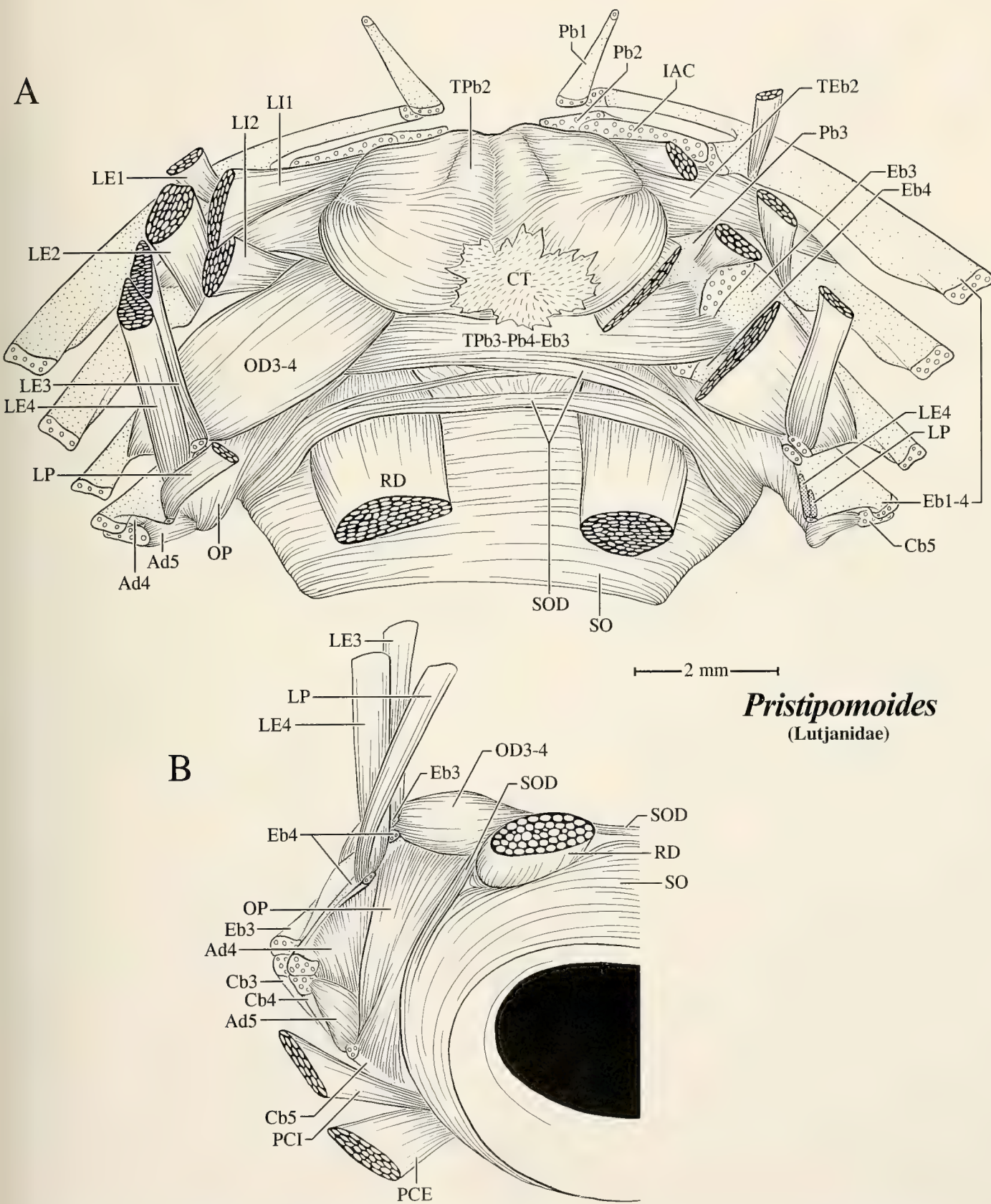


Plate 112. *Pristipomoides aquilonaris*, USNM 158472: A, dorsal view, right-side OD3-4 bisected and LE4 and LP removed (insertion positions indicated by shading), Pb1s pivoted anteriorly. B, posterior view, left side.





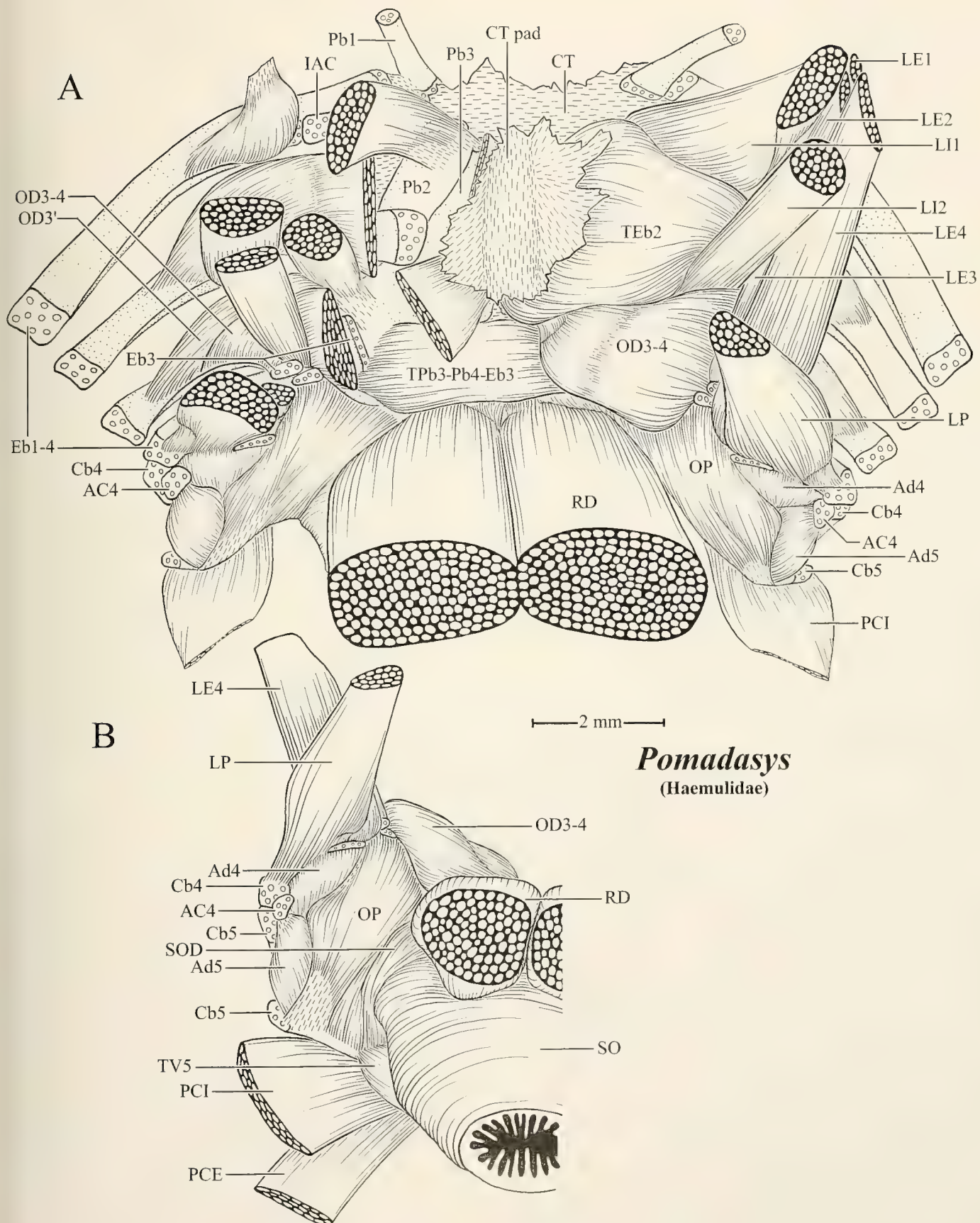
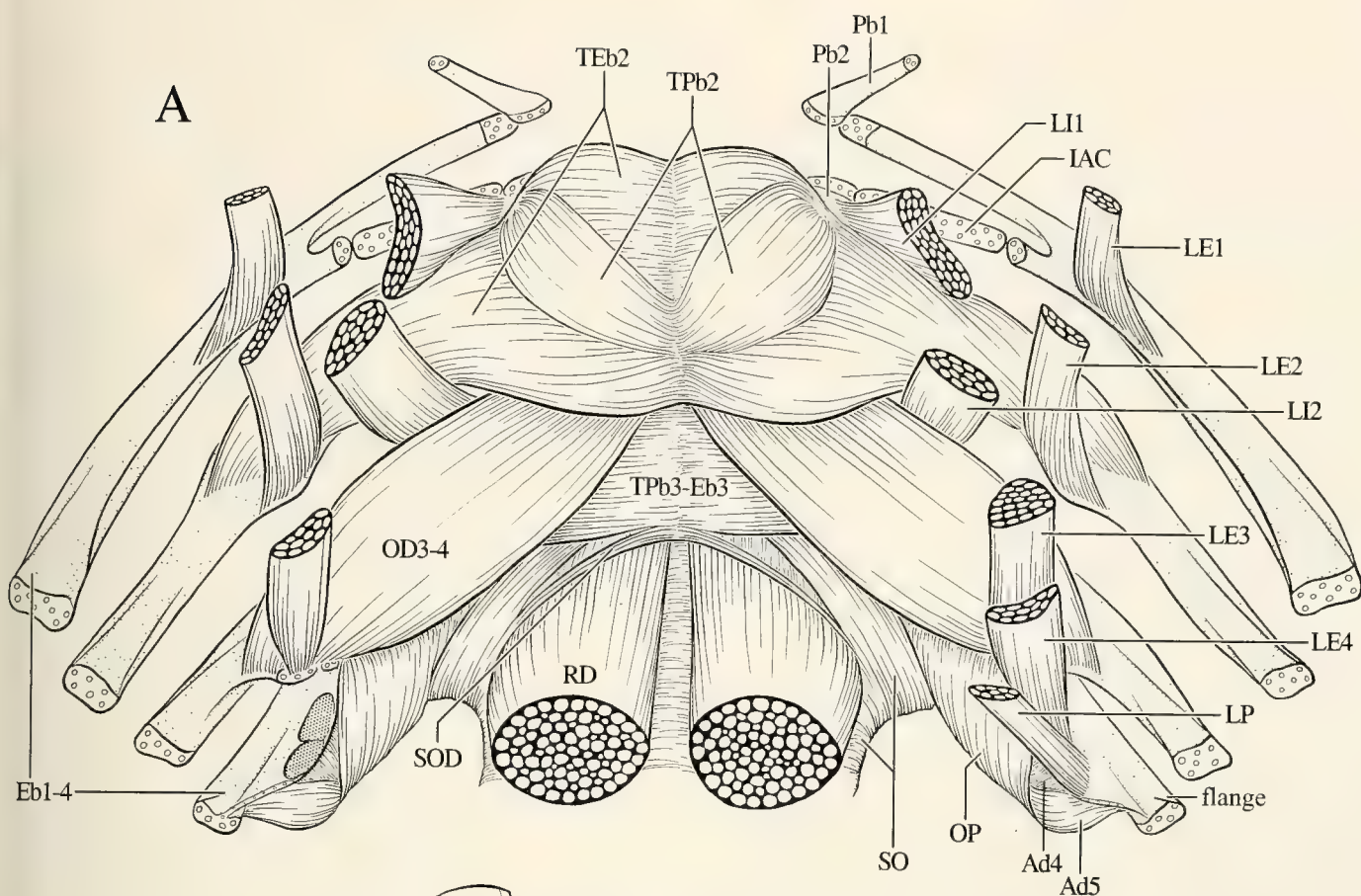
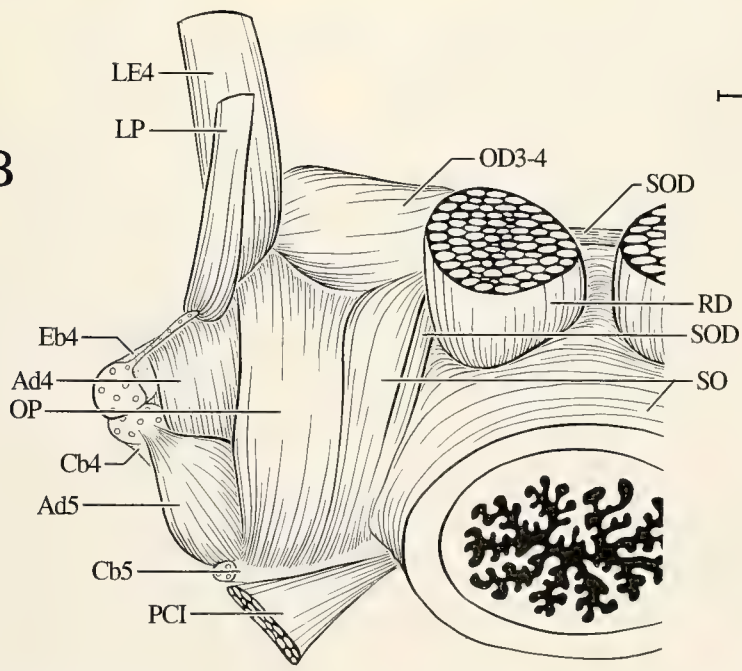


Plate 113. *Pomadasys crocro*, USNM 338643: A, dorsal view, left-side TEb2 and OD3-4 bisected, most levators greatly truncated. B, posterior view, right side reversed.





**B**



***Glossamia***  
(Apogonidae)

Plate 114. *Glossamia wichmanni*, USNM 344886: A, dorsal view, left-side LE4 and LP removed (insertion positions indicated by shading). B, posterior view, left side.









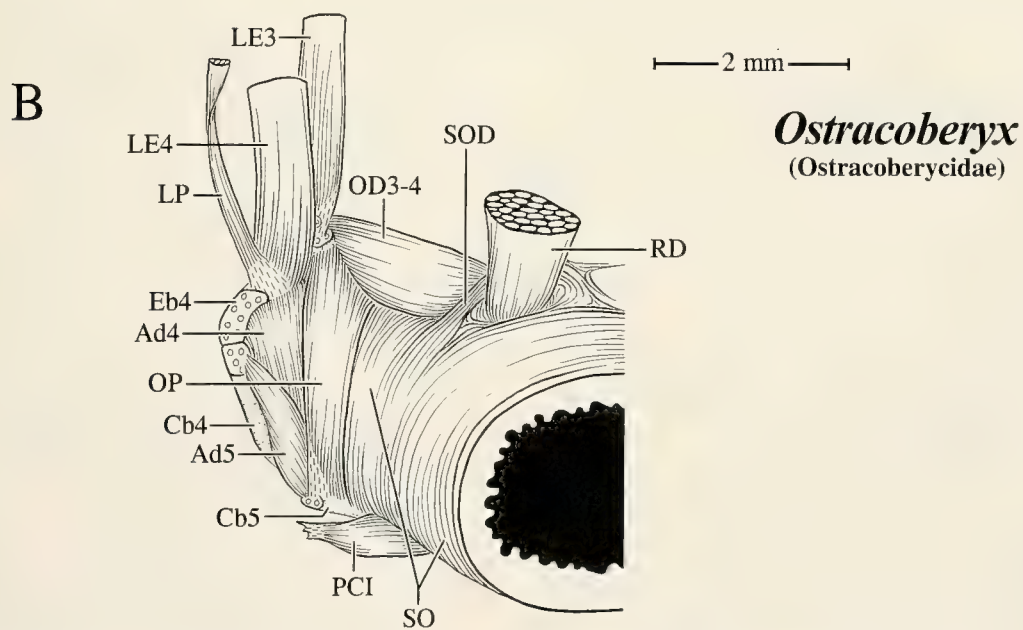
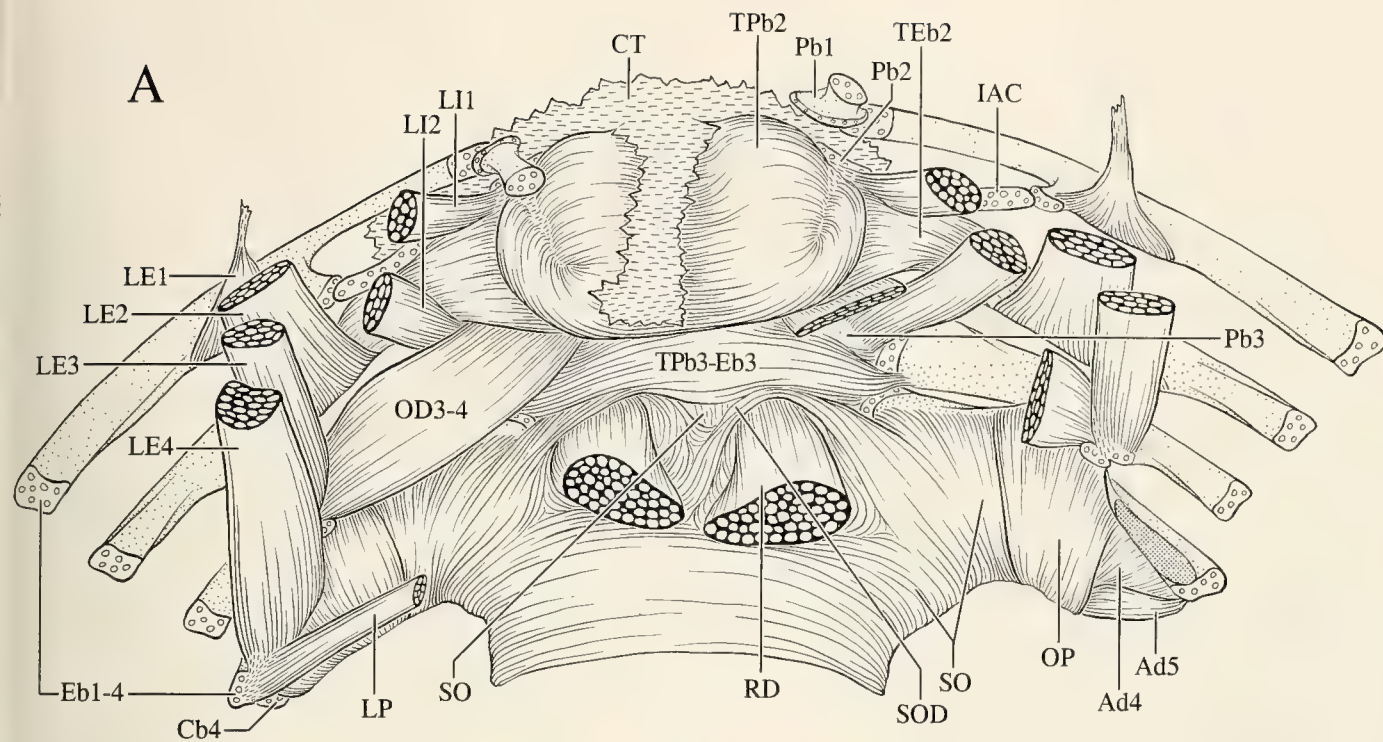


Plate 116. *Ostracoberyx dorygenys*, USNM 307282: A, dorsal view, right-side LE4 and LP removed (insertion positions indicated by shading), OD3-4 bisected, LE3 and 4 truncated (left side also). B, posterior view, right-side reversed.





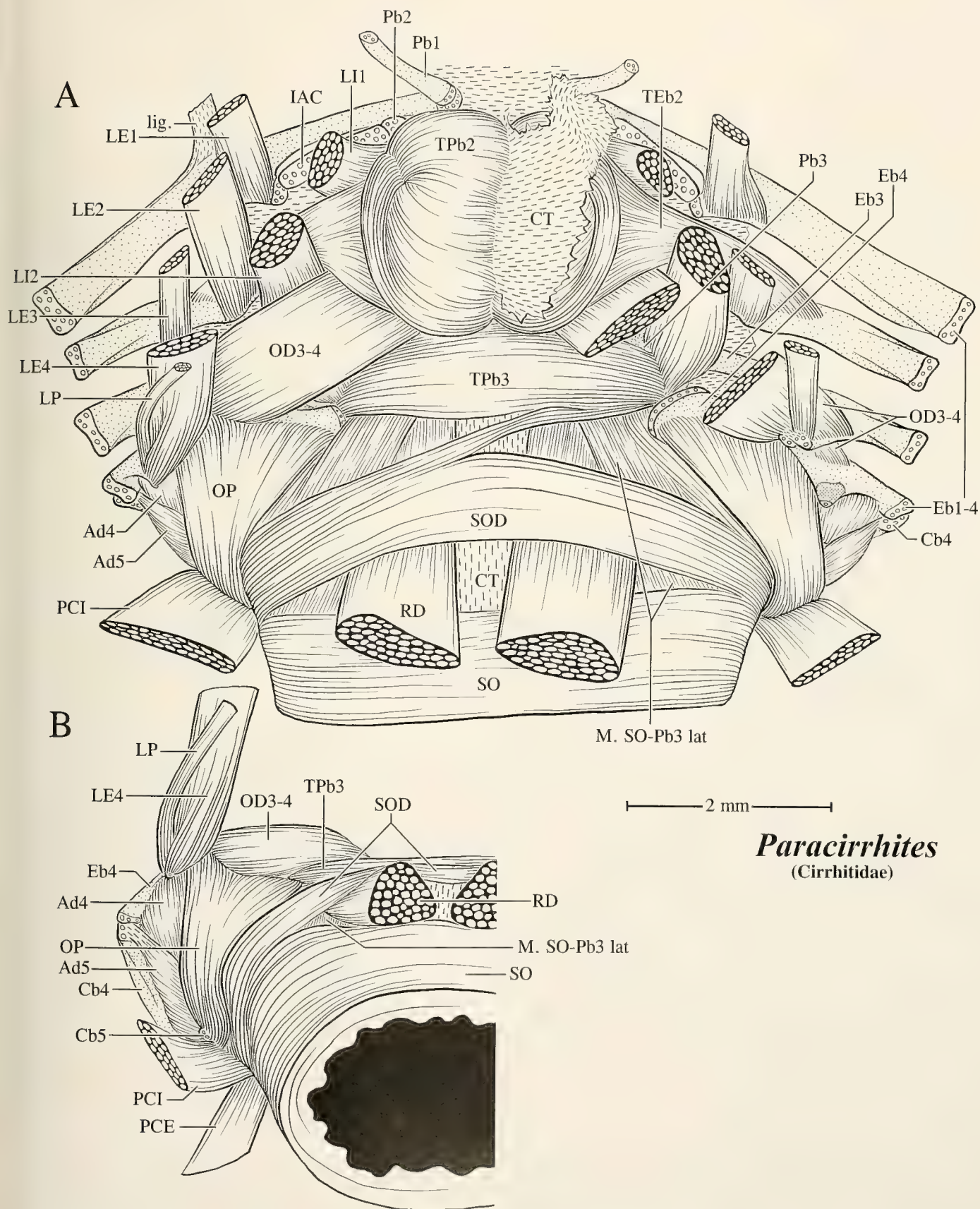


Plate 117. *Paracirrhites fosteri*, USNM 278070: A, dorsal view, right-side OD-3-4 bisected, ligament anterior to LE1 removed, and LE4 and LP removed (insertion positions shown by shading). B, posterior view, right side reversed.



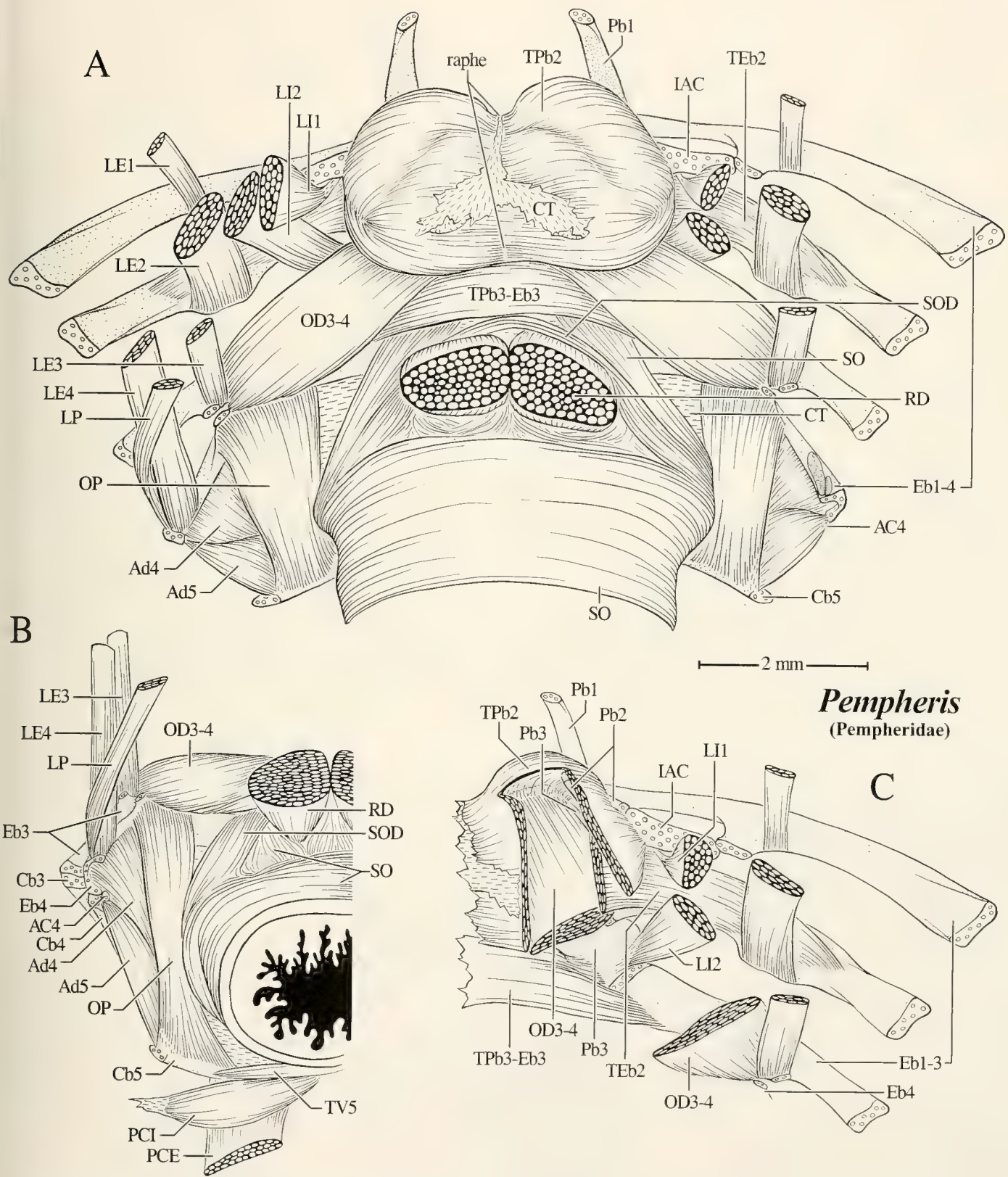
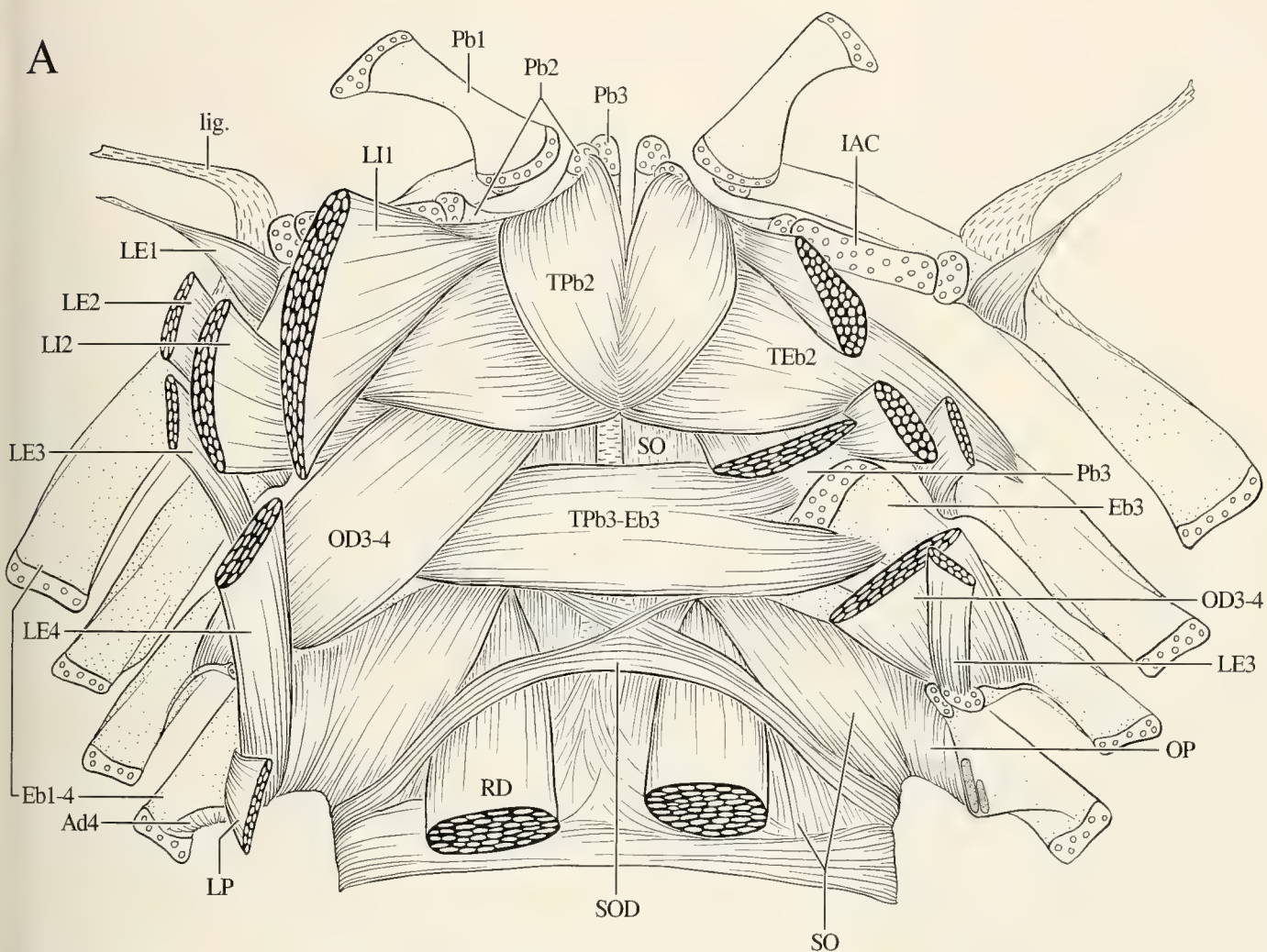


Plate 118. *Pempheris schomburgkii*, USNM 31858: A, dorsal view, dorsal CT trimmed and right-side LE4 and LP removed (insertion positions shown by shading); fine ligament (not illustrated) arises from Eb1 anterior to LE1. B, posterior view, right side reversed. C, dorsoanterior view, right side, dorsal portion of TPb2 cut away to reveal attachment of anterior fibers to Pb3, TEb2 passing ventral to TPb2 and dorsal to OD3-4, TEb2 cut away to reveal OD3-4 attachment to Pb3 anteriorly (anterior end of Pb3 indicated by dotted line to left of Pb2), OD3-4 cut away to show attachment of LI2 to Pb3.

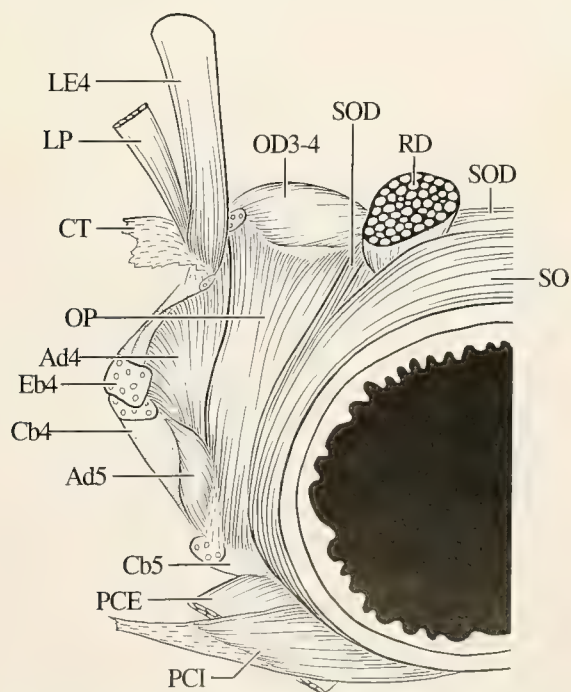




A



B



— 2 mm —

*Lactarius*  
(Lactariidae)

Plate 119. *Lactarius lactarius*, USNM 343873: A, dorsal view, right-side OD3-4 cut away to reveal LI2 insertion and TPb3-Eb3 attachment; right-side LE4 and LP removed (insertion positions indicated by shading). B, posterior view, right side reversed, LE4 and LP forced laterally.



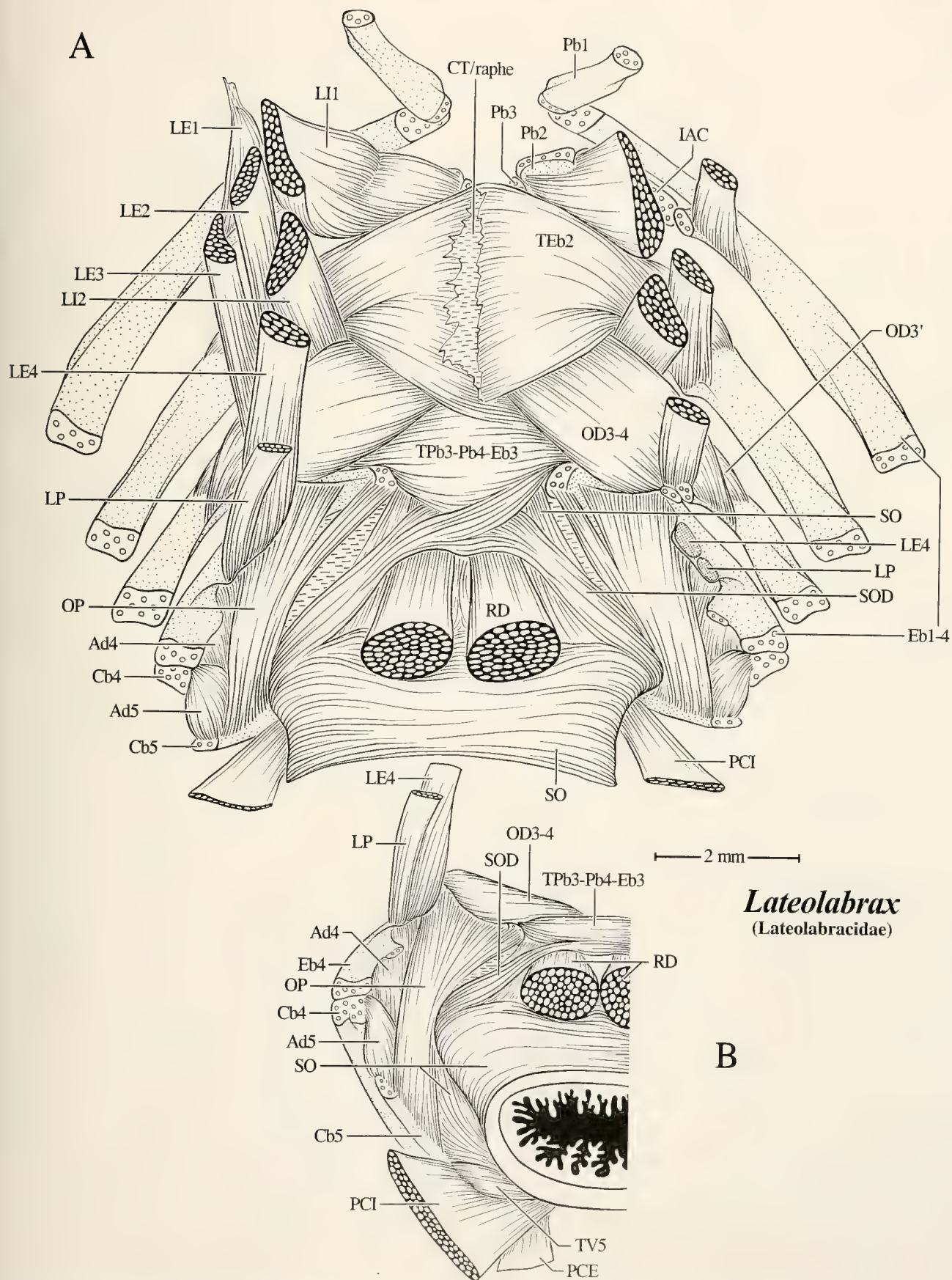


Plate 120. *Lateolabrax japonicus*, USNM 344295: A, dorsal view, right-side dorsal CT, LE4, and LP removed (insertion positions indicated by shading). B, posterior view, right side reversed (Eb4 levator process, lateral to LP insertion, absent on left side).





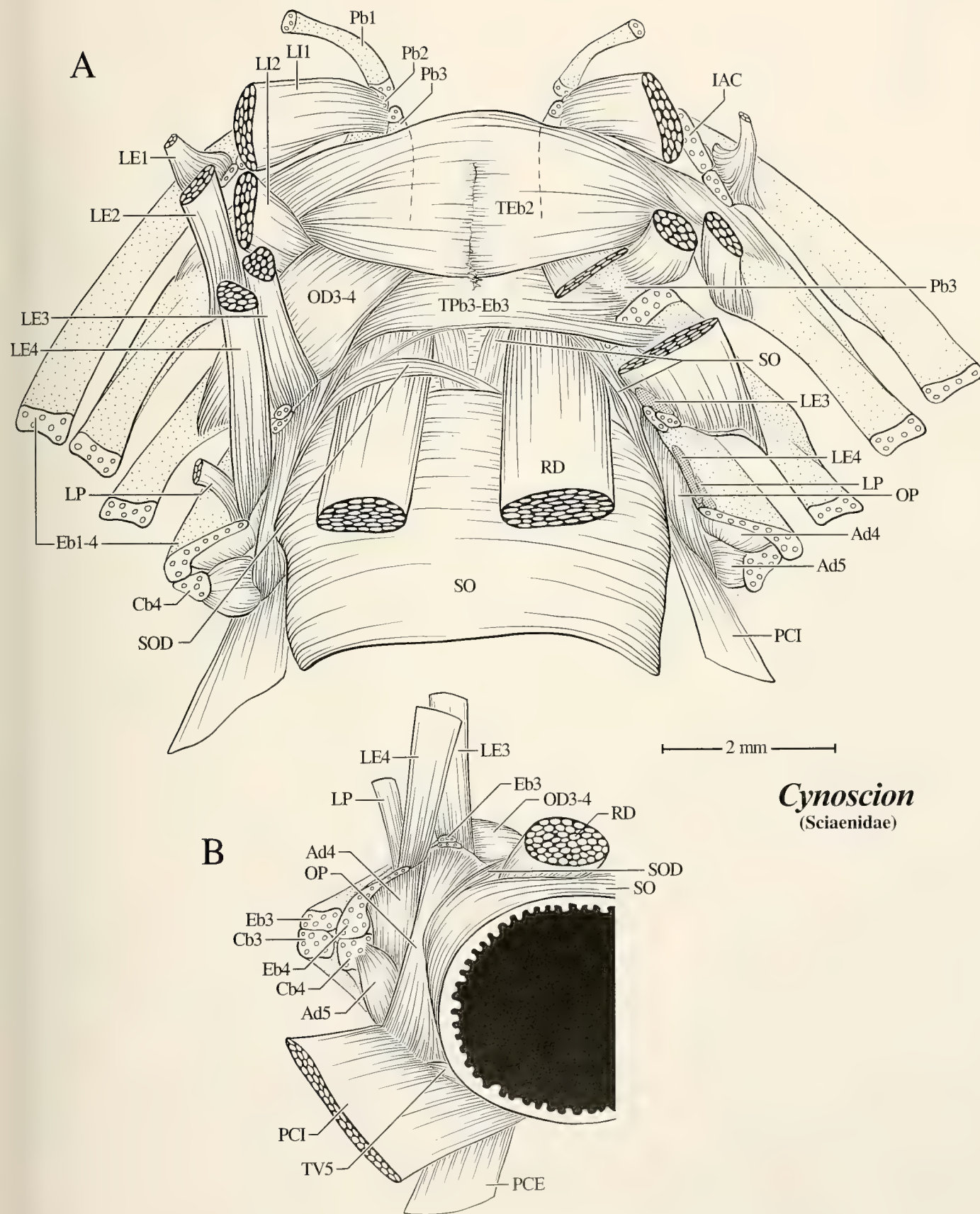


Plate 121. *Cynoscion nebulosus*, USNM 176237: A, dorsal view, right side OD3-4 cut away and LE4 and LP removed (insertion positions indicated by shading), SOD anomalous. B, posterior view, left side.



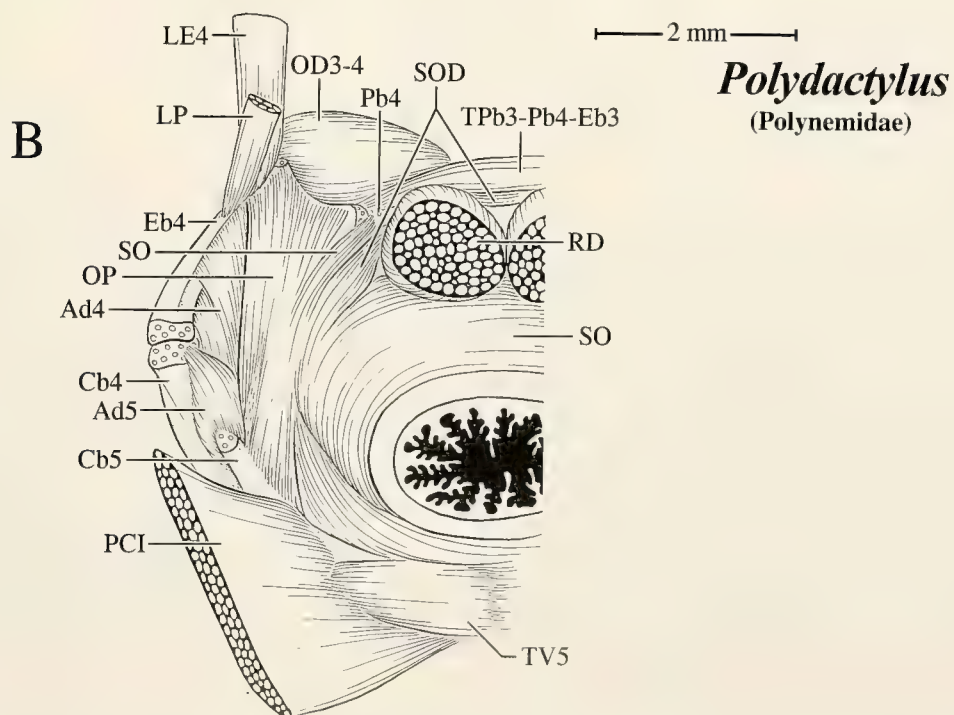
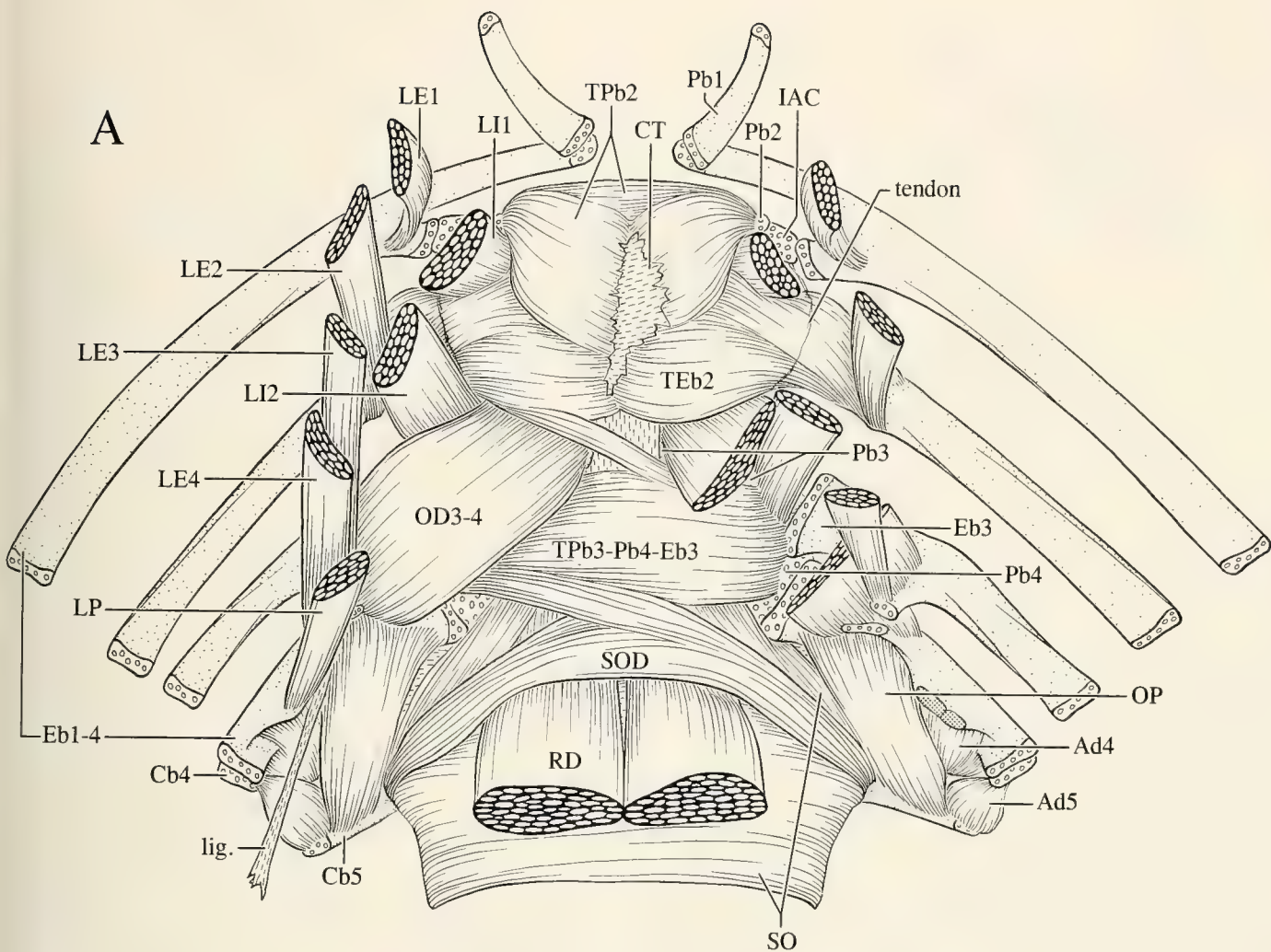


Plate 122. *Polydactylus oligodon*, USNM 364370: A, dorsal view, right-side OD3-4 bisected and LE4 and LP removed (insertion positions indicated by shading). B, posterior view, left side.





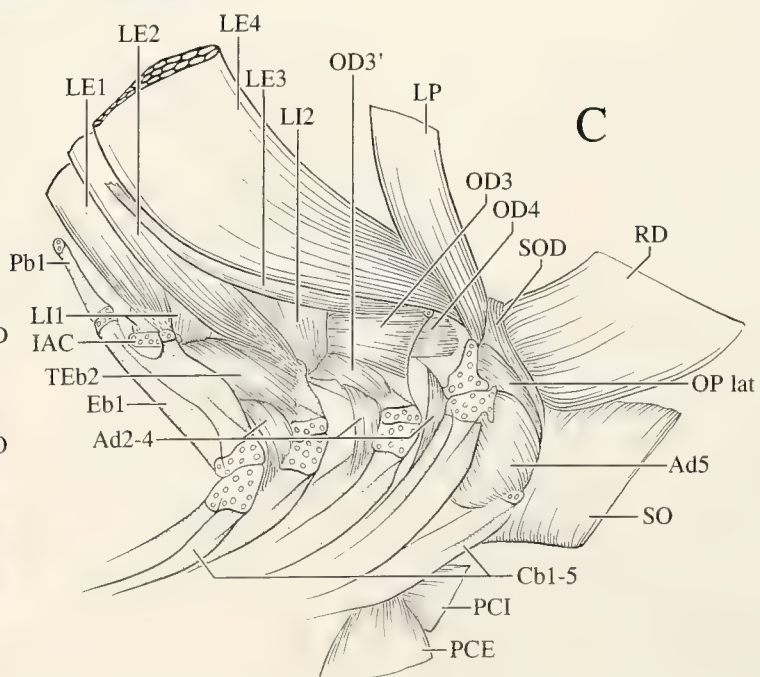
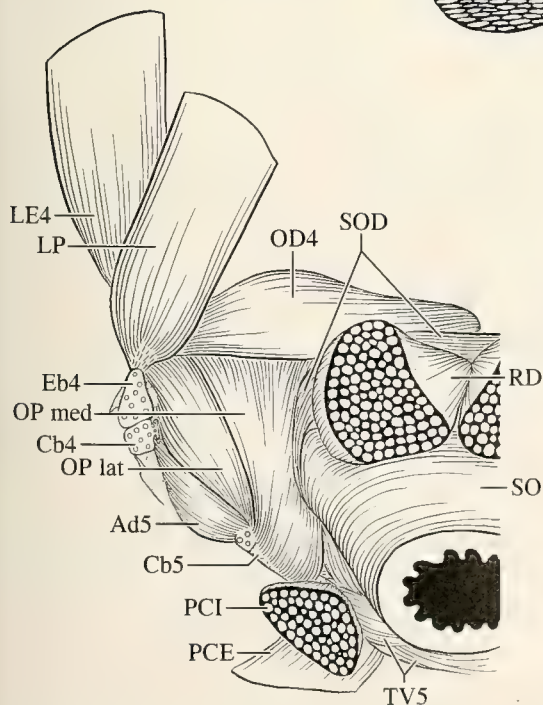
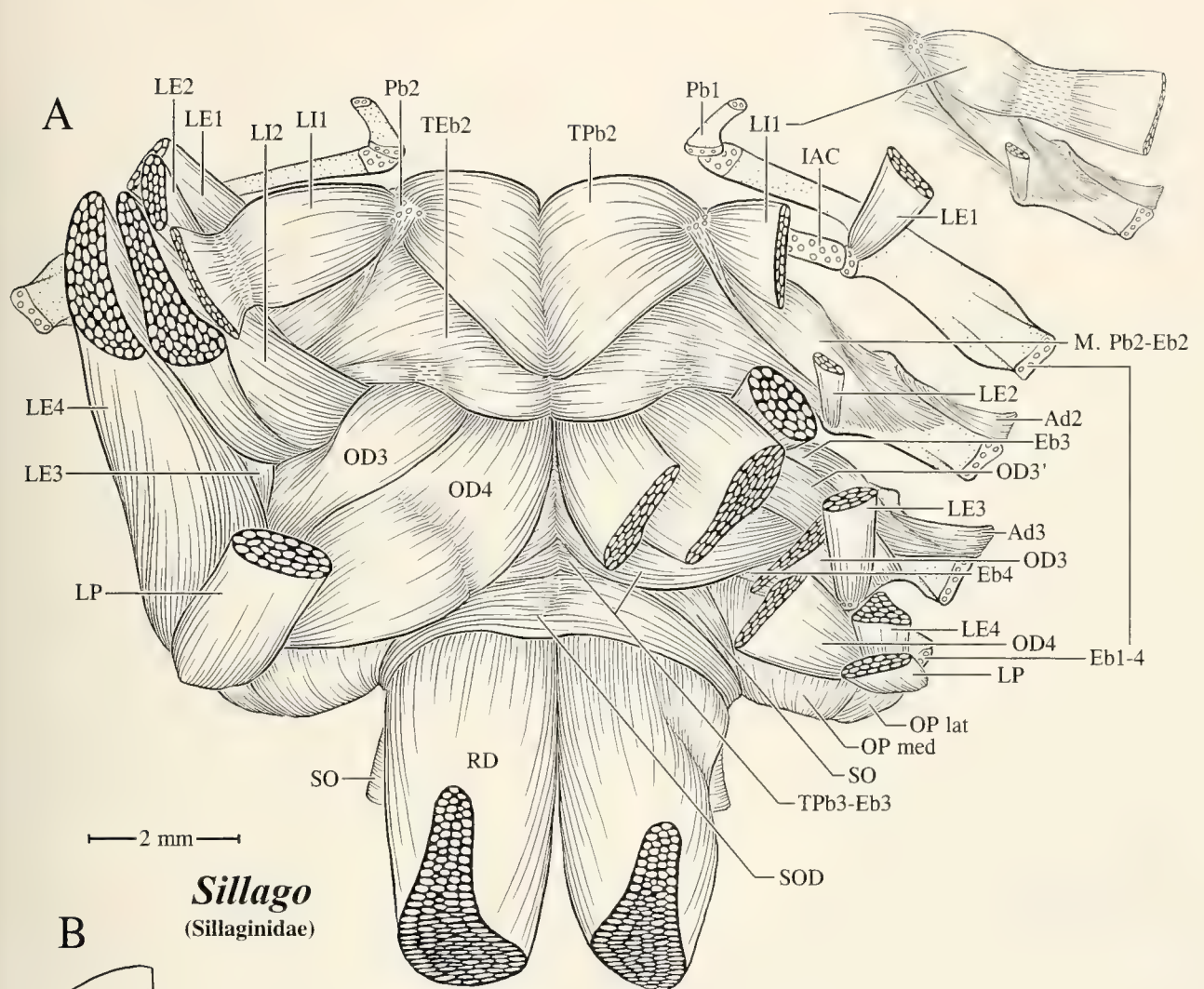


Plate 123. *Sillago sihama*, USNM 347113: A, dorsal view, OD3, OD3', and OD4 bisected; LI1 partially rotated ventrolaterally in inset at upper right to show membranous mid-portion; B, posterior view, left side; C, lateral view.



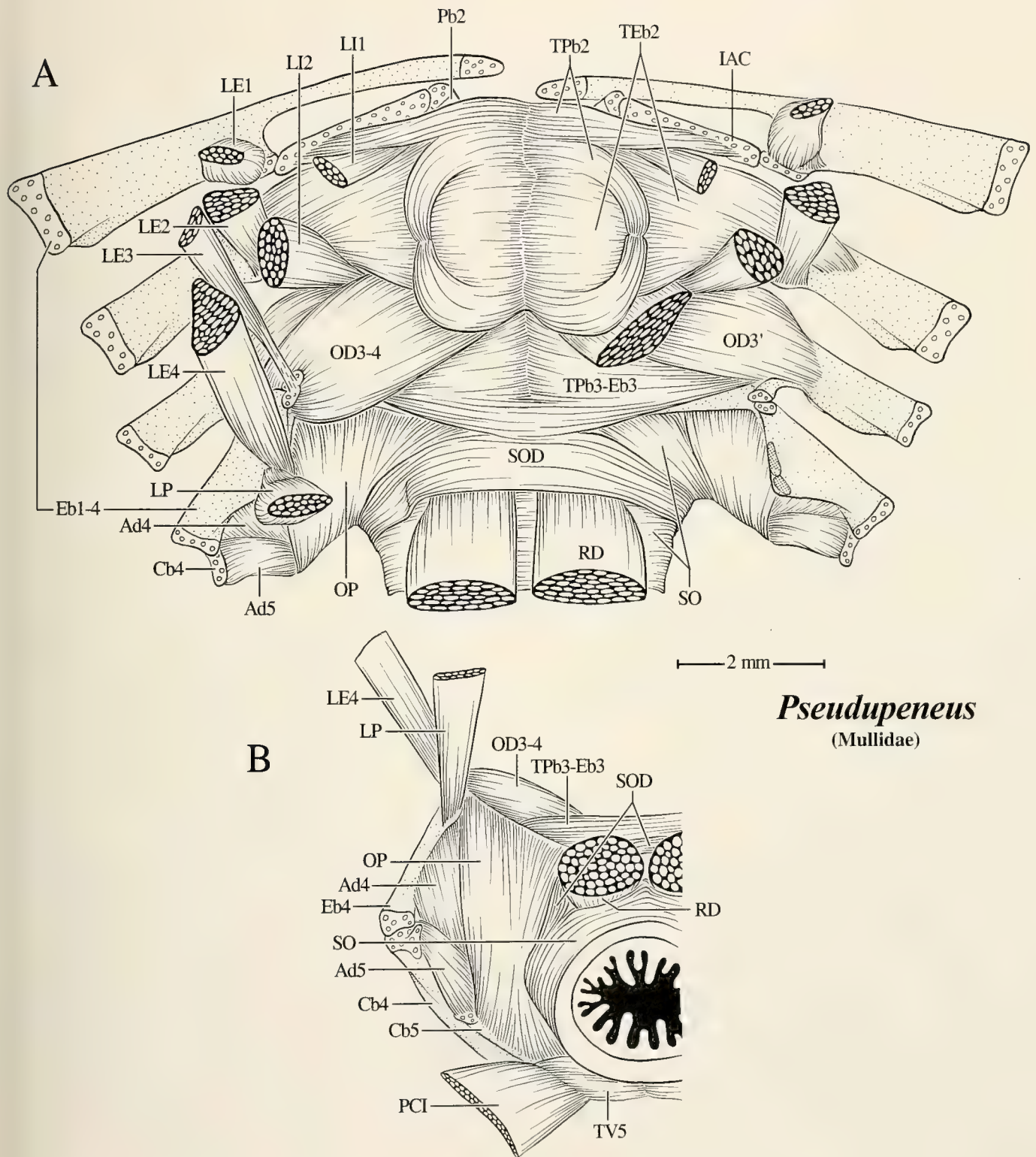
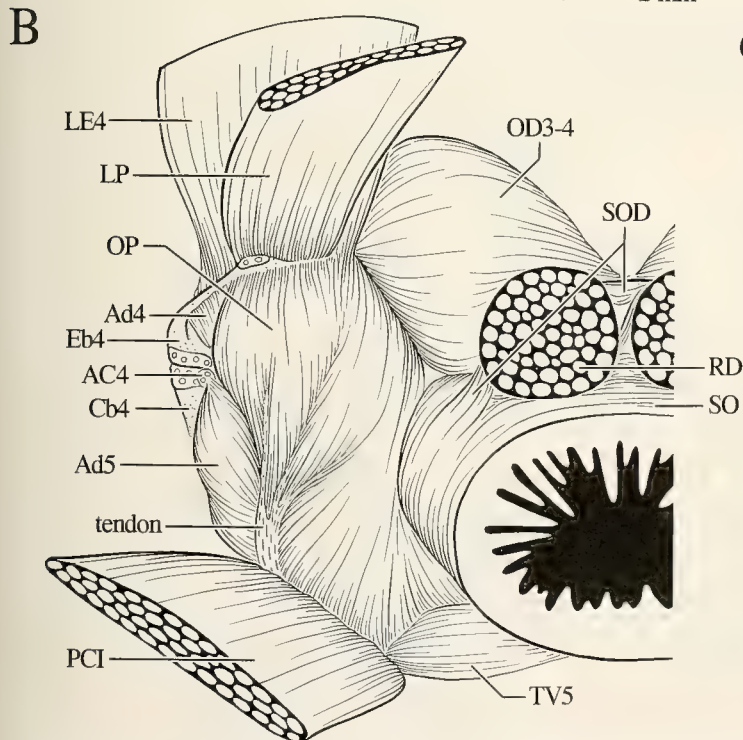
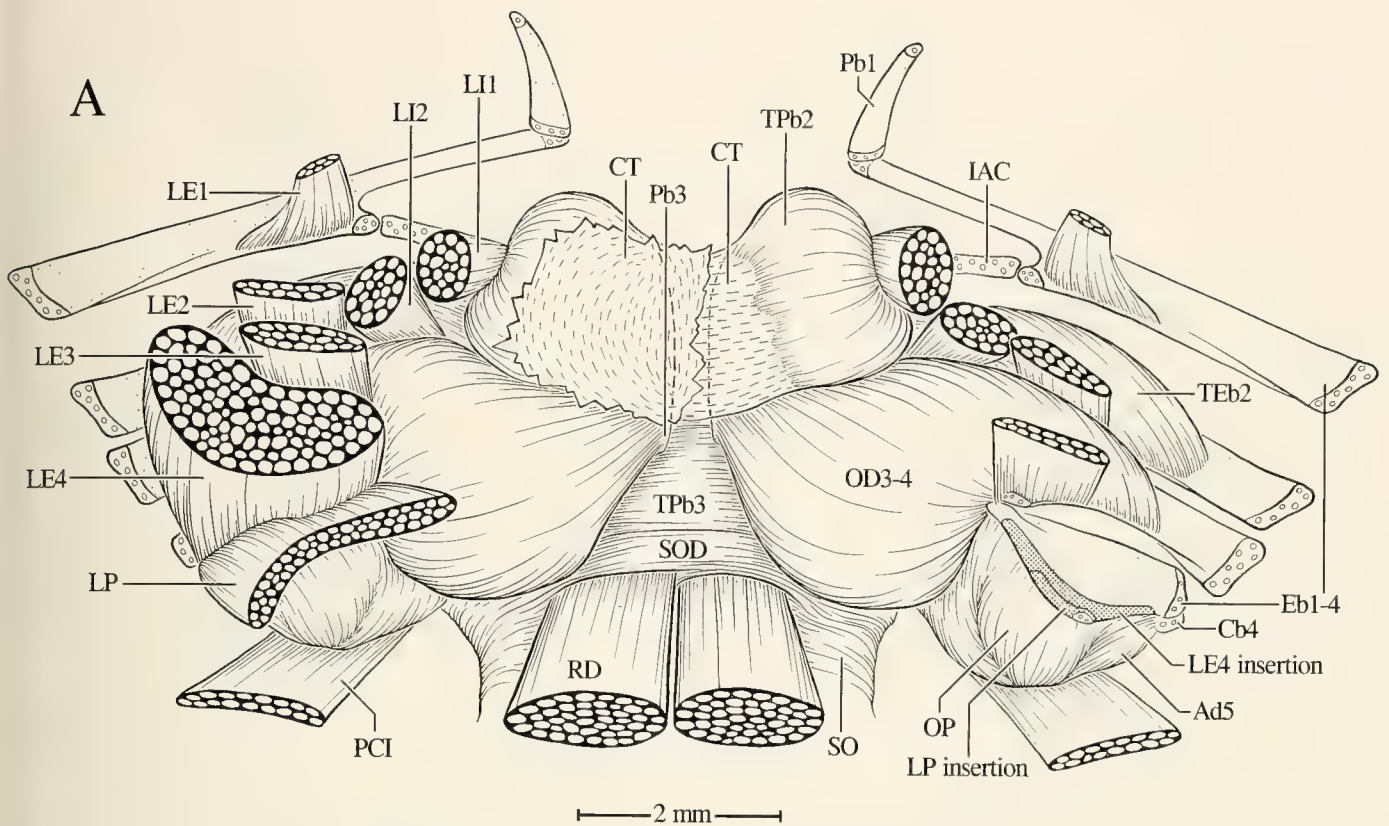


Plate 124. *Pseudupeneus maculatus*, USNM 267508: A, dorsal view, right-side OD cut away to reveal OD3' insertion; LE3, LE4, and LP removed (LE3 and LE4 insertion positions indicated by shading). B, posterior view, left side.







*Centrogenys*  
(Centrogeniidae)

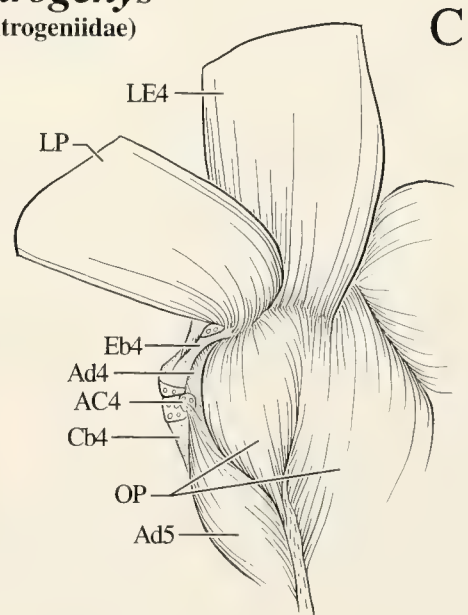


Plate 125. *Centrogenys vaigiensis*: A, B, USNM 183016: A, dorsal view; right-side LE4 and LP removed and CT pad cut away, vertical dashed lines represent medial margins of Pb3s, which are ventral to CT joining TPb2s. B, posterior view, left side, only ventro-medial LE4 fibers continuous with OP. C, USNM 327899, posterior view, left side, LP forced laterally to reveal continuation of LE4 with OP.



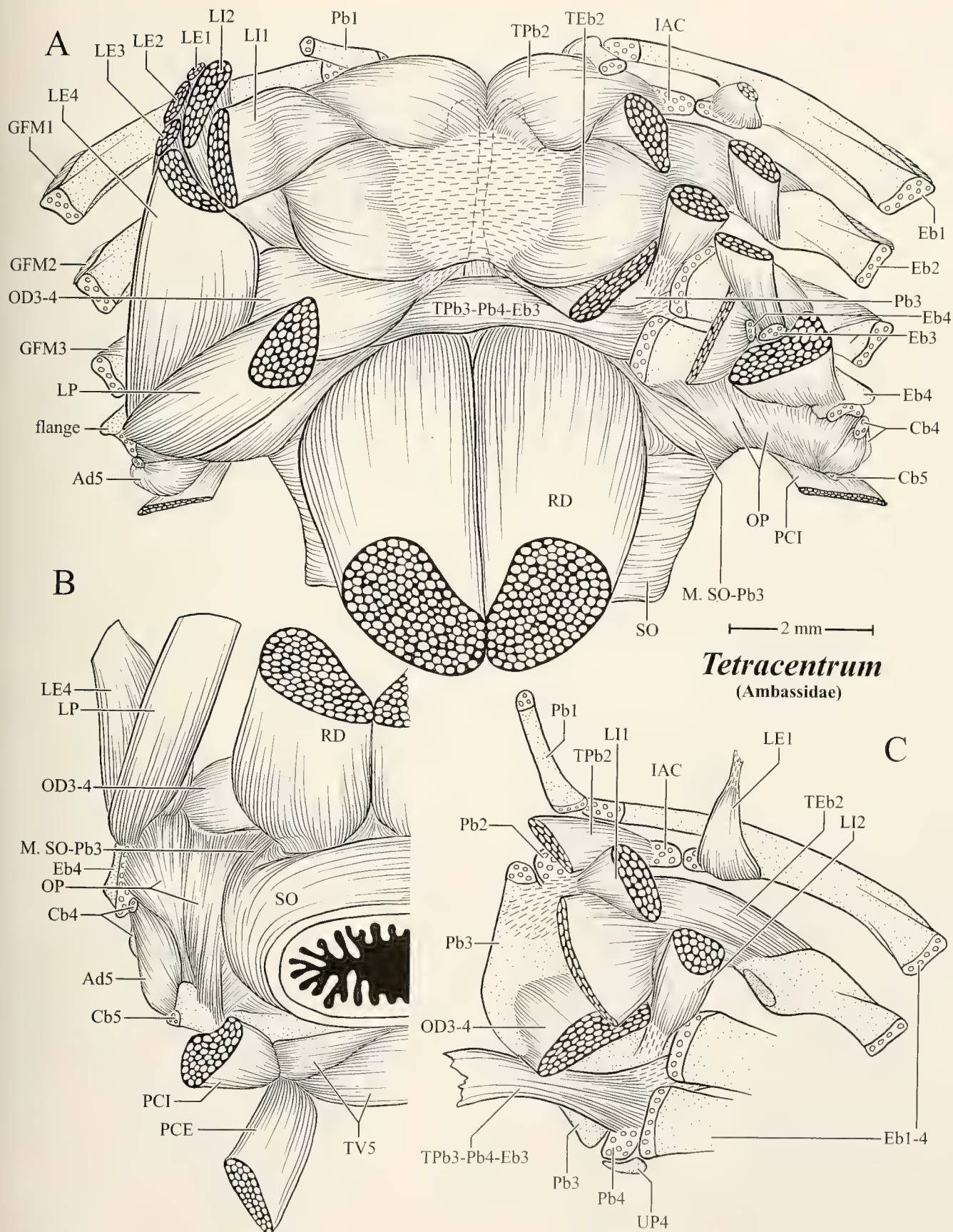


Plate 126. *Tetracentrum caudovittatus*, USNM 332862: A, dorsal view, right-side OD3-4 bisected, LP removed (insertion position indicated by shading), levators greatly truncated; dashed lines anteromedially outline medial margins of Pb3s obscured by CT and TPb2. B, posterior view, left side. C, dorsoanterior view, right side to show muscle attachments obscured in A; TPb2 and TEb2 cut away medially, OD3-4 cut away laterally, M. SO-Pb3 removed, LE2 removed (insertion position indicated by shading), LE1 pivoted anteriorly from insertion, LI1 and LI2 truncated.





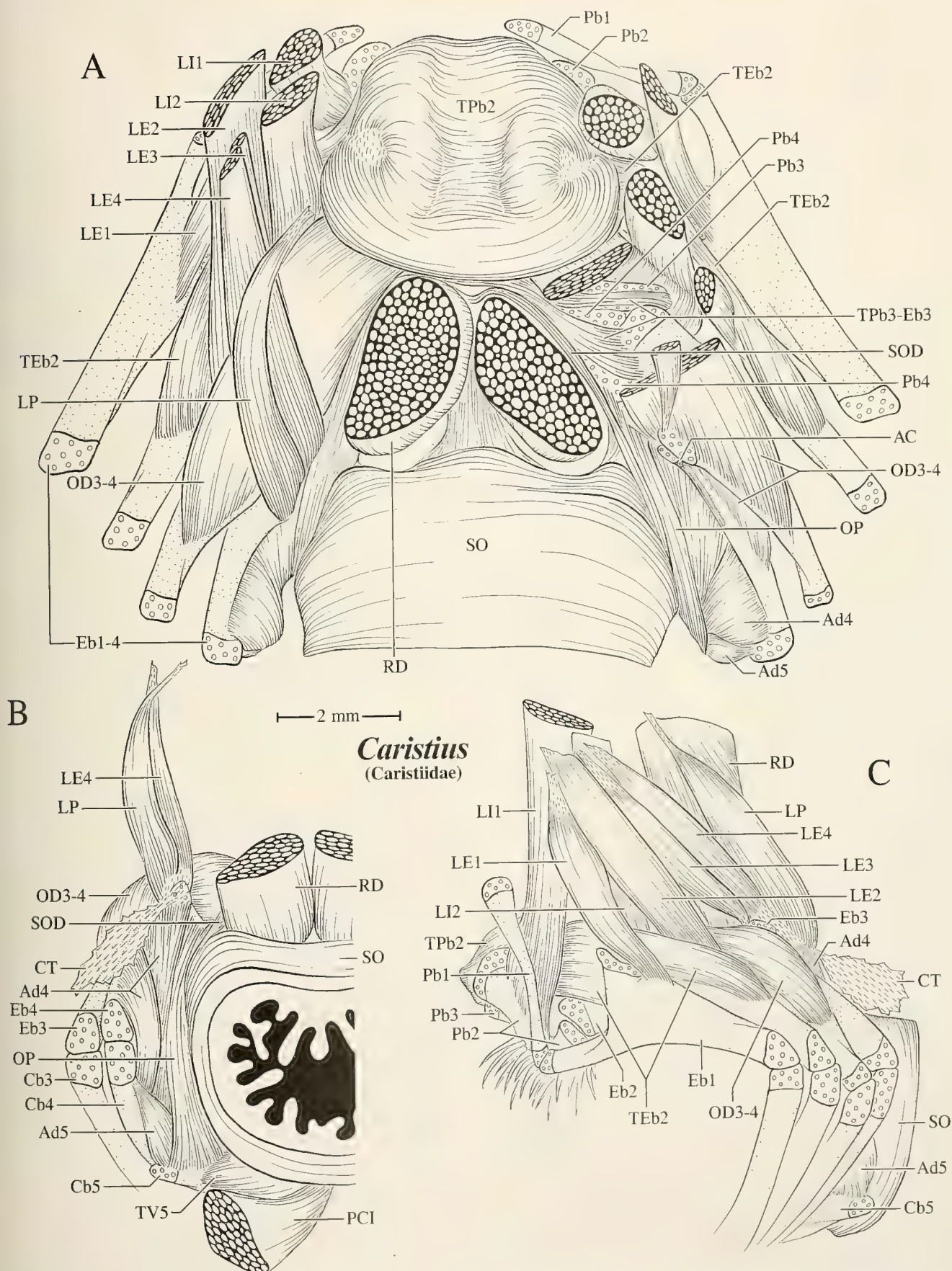
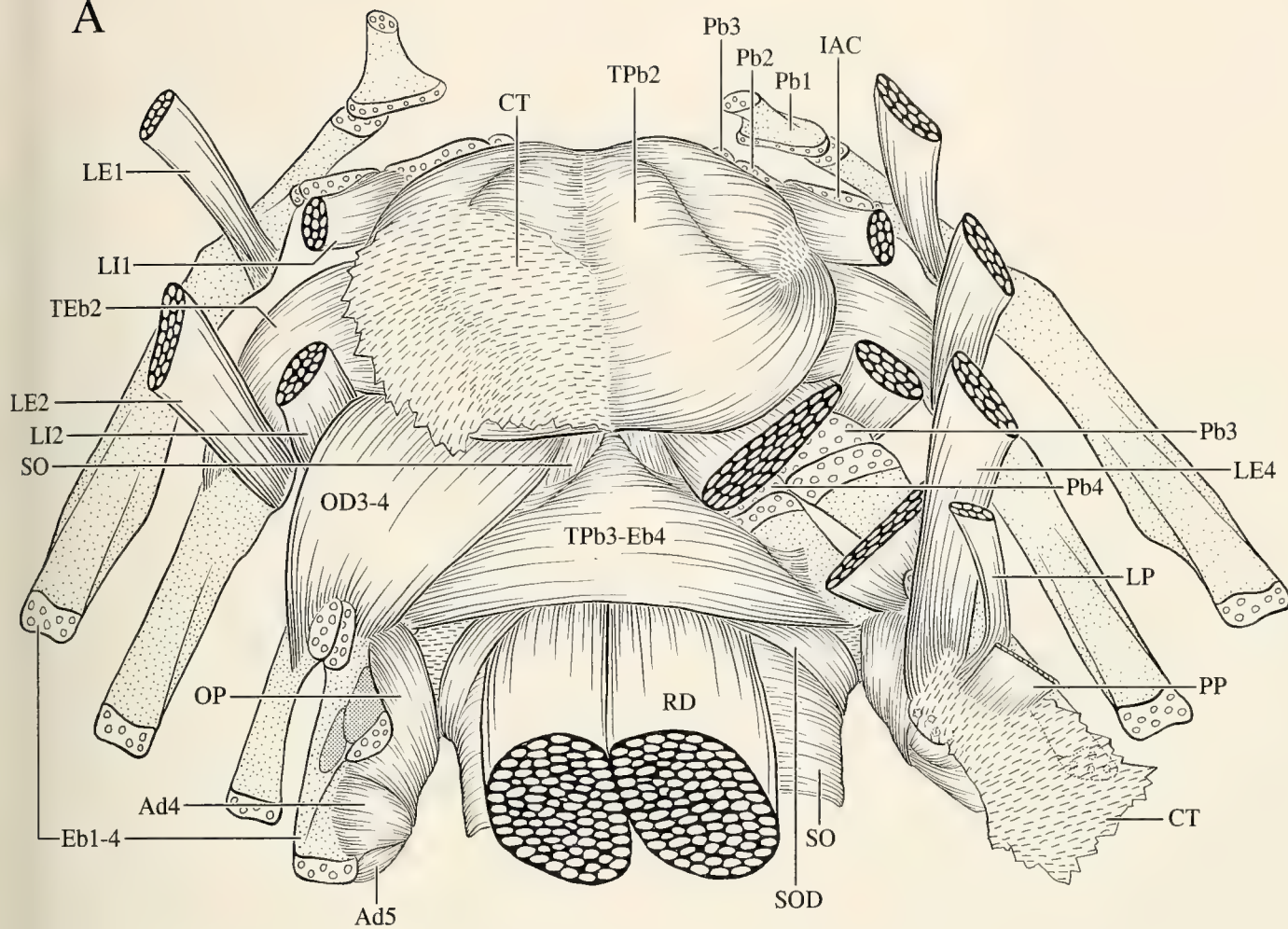


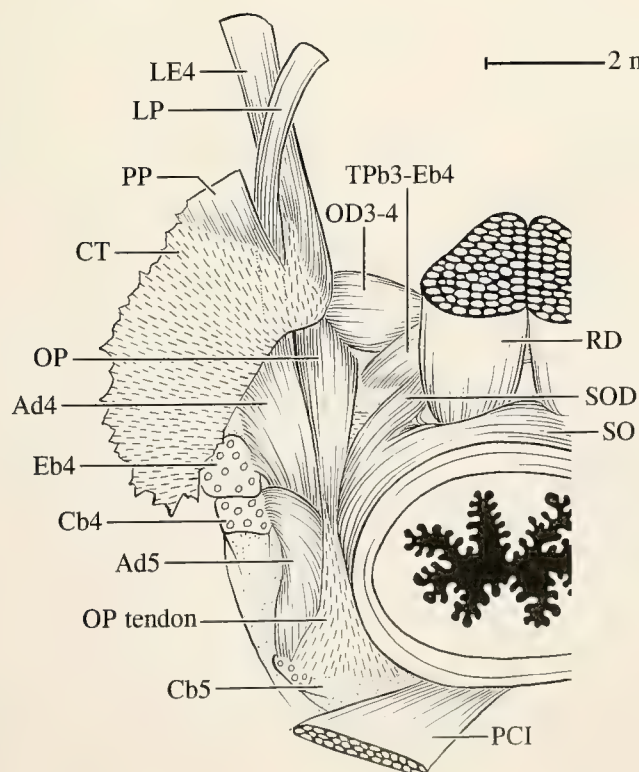
Plate 127. *Caristius maderensis*, USNM 206895: A, dorsal view; right-side LE4 and LP removed (insertion positions shown by shading), other levators and RD greatly truncated, right-side OD3-4 cut away to reveal underlying muscle attachments. B, posterior view, left side. C, lateral view, left side.



A



B



***Brama***  
(Bramidae)





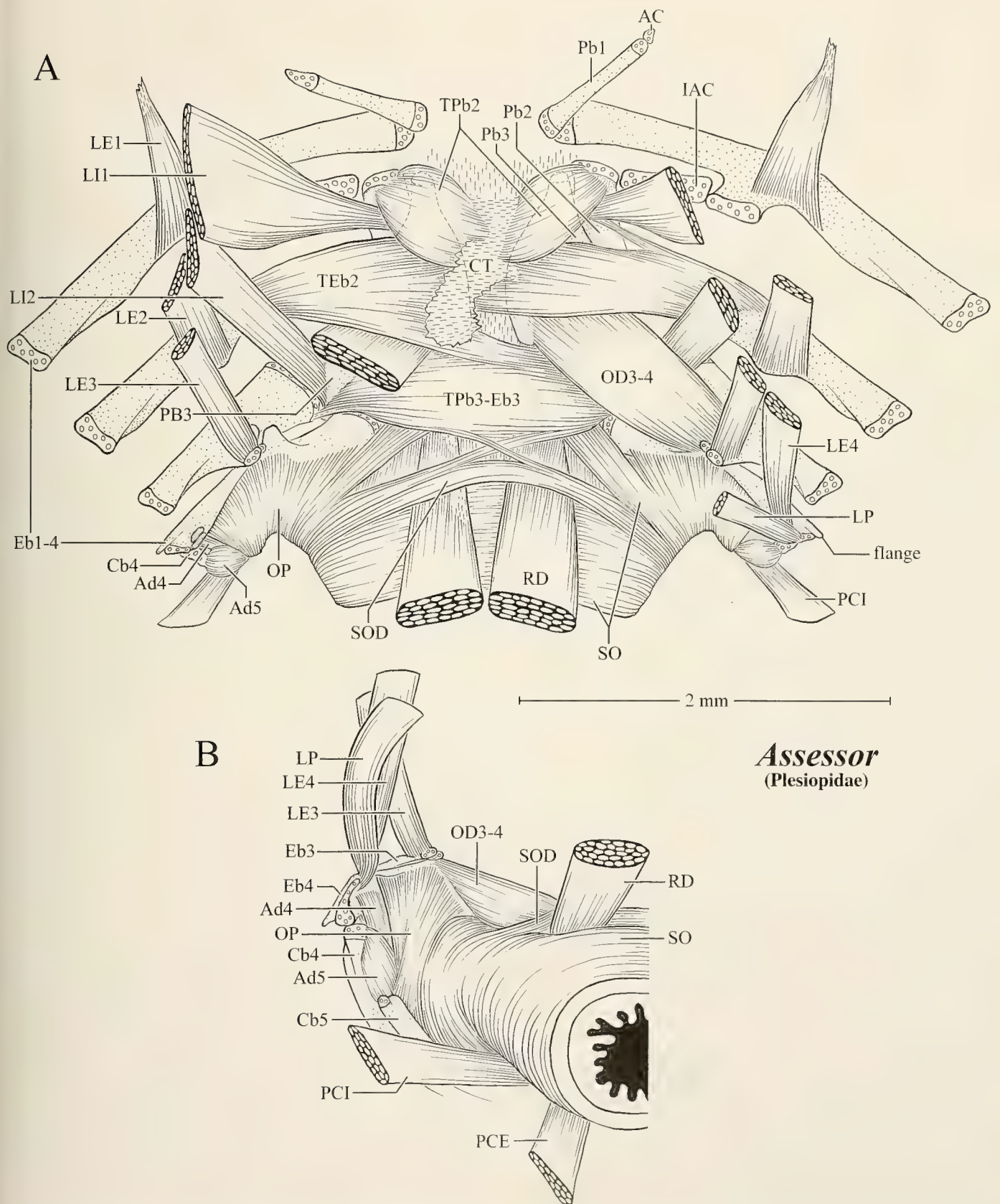


Plate 129. *Assessor macneilli*, composite of USNM 269466 (Eb4 levator process present) and 274581 (Eb4 levator process absent): A, dorsal view, left-side OD3-4 bisected, and LE4 and LP removed (insertion positions indicated by shading), right-side CT removed in region dorsal to Teb2 and TPb2 to expose partially naked articulating fascet. B, posterior view, right side reversed.



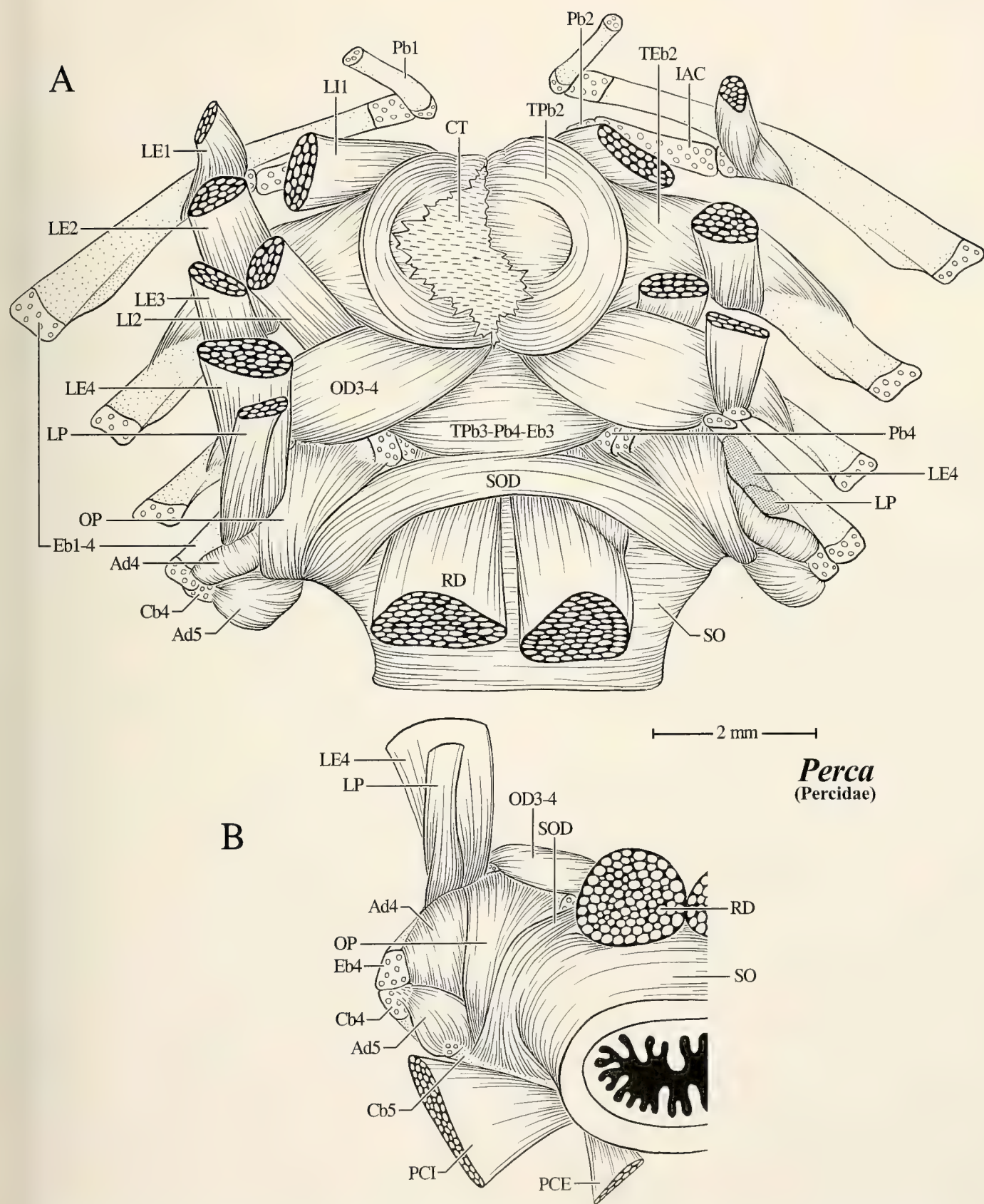


Plate 130. *Perca flavescens*, USNM 193135: A, dorsal view: dorsal, right-side LE4 and LP removed (insertion positions indicated by shading). B, posterior view, left side.





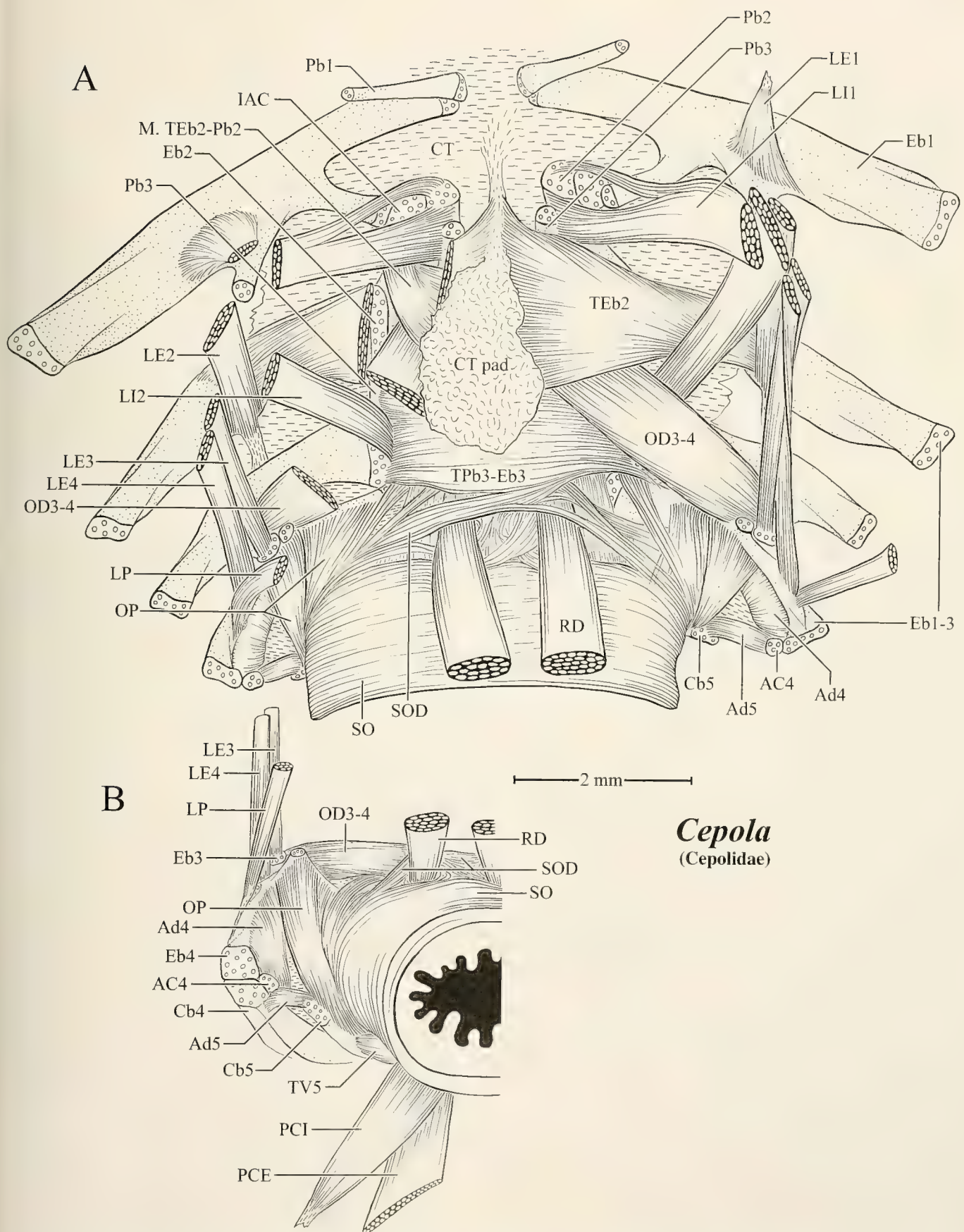
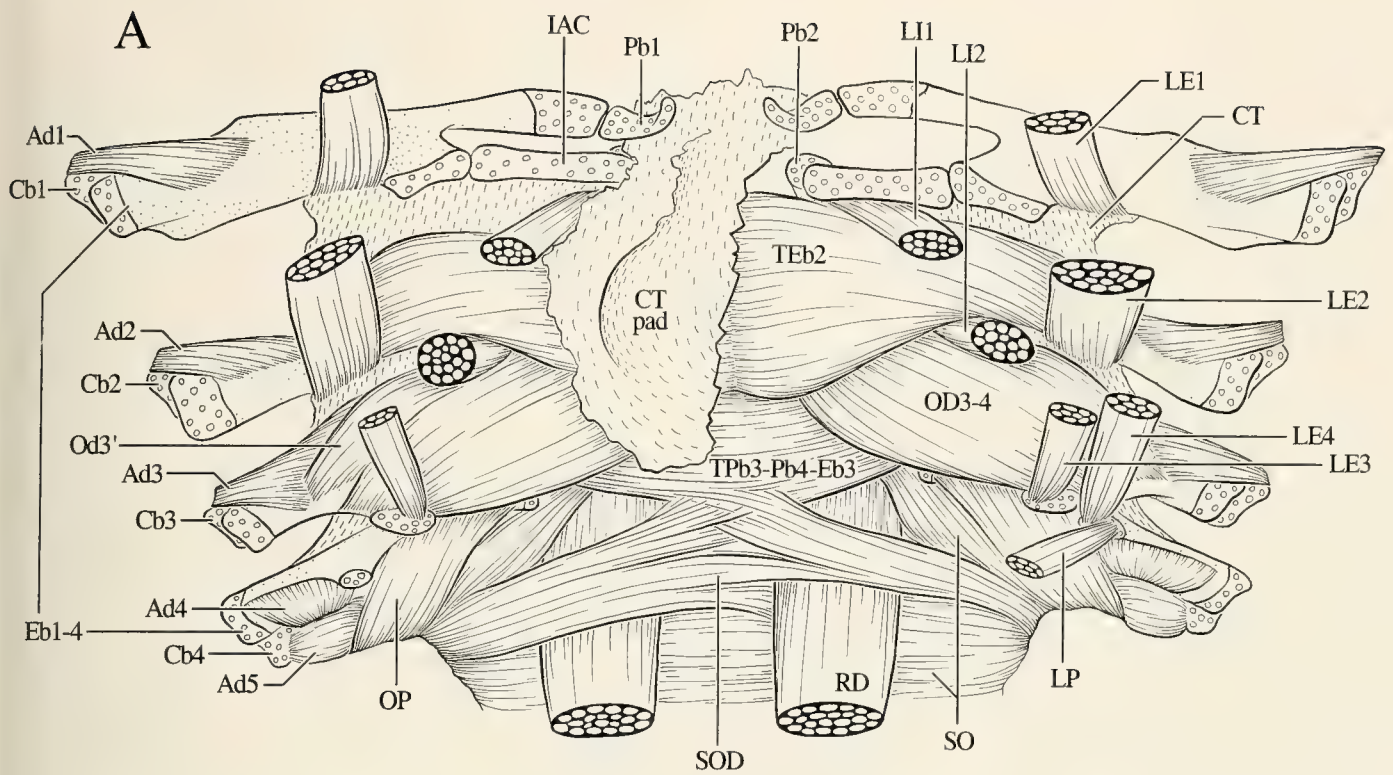


Plate 131. *Cepola rubescens*, USNM 285452: A, dorsal view, left-side TEb2 and OD3-4 bisected. B, posterior view, right side reversed.





— 2 mm —

***Callanthias***  
(Callanthiidae)

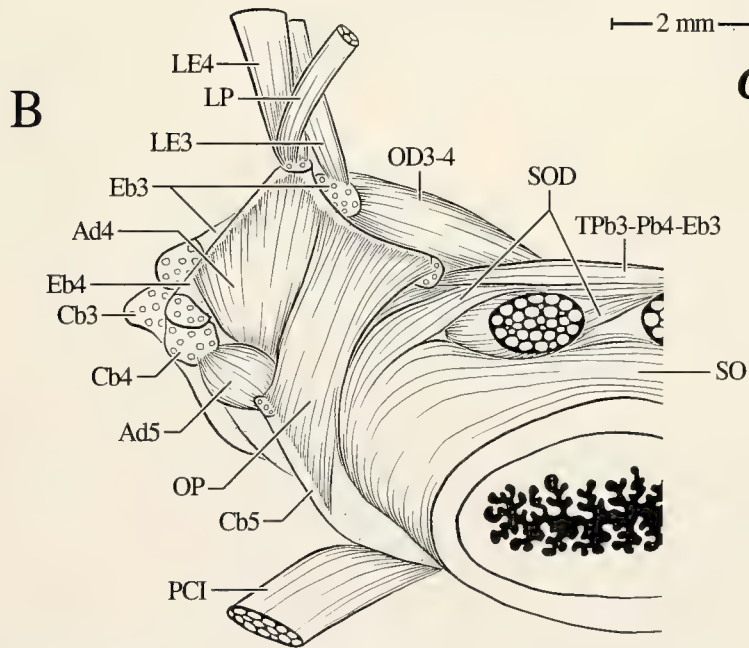
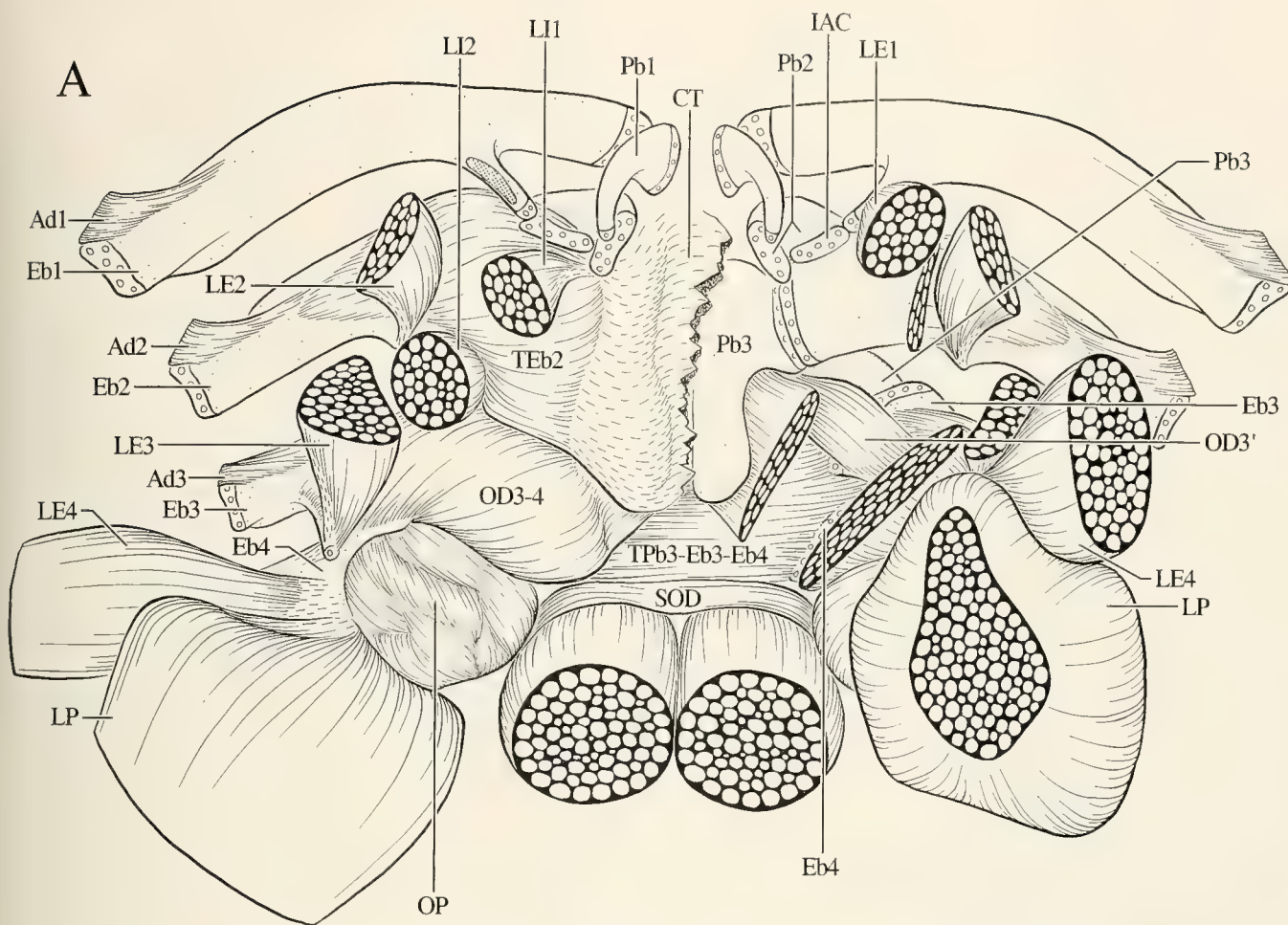


Plate 132. *Callanthias allporti*, USNM 350940: A, dorsal view: right-side dorsal CT pad cut away, left-side LE4 and LP removed, OD attachment to Eb4 not visible. B, posterior view, right side reversed.







2 mm

***Gerres***  
(Gerreidae)

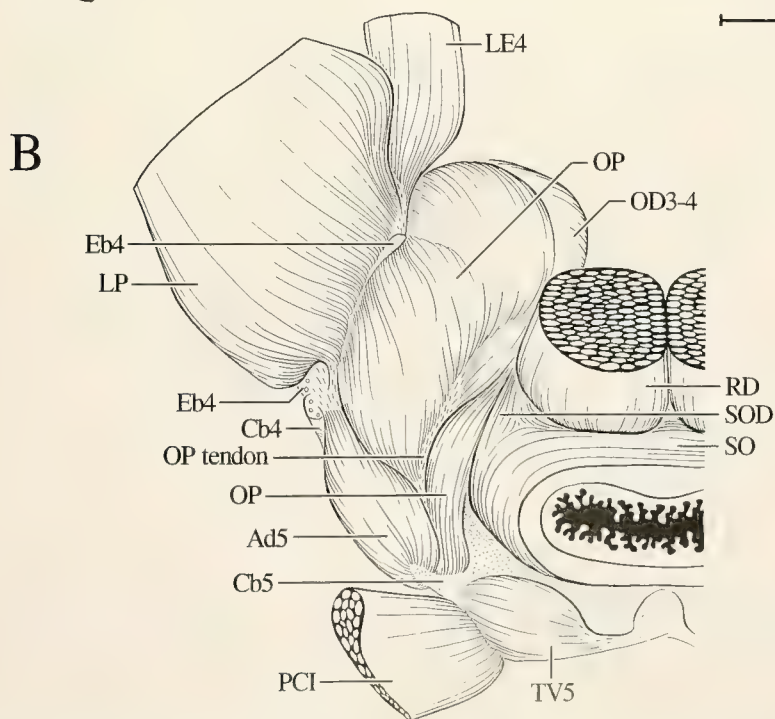
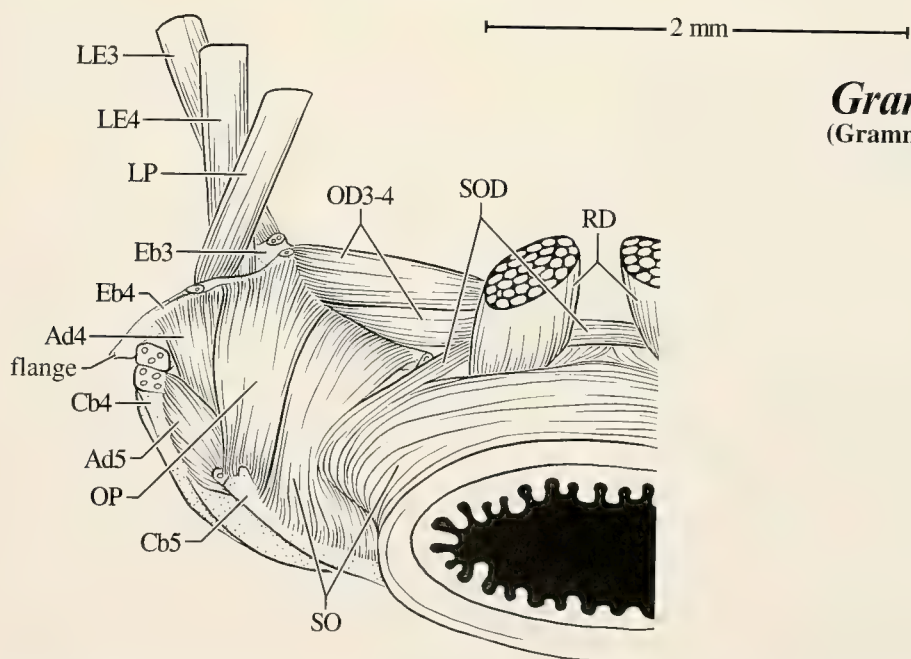
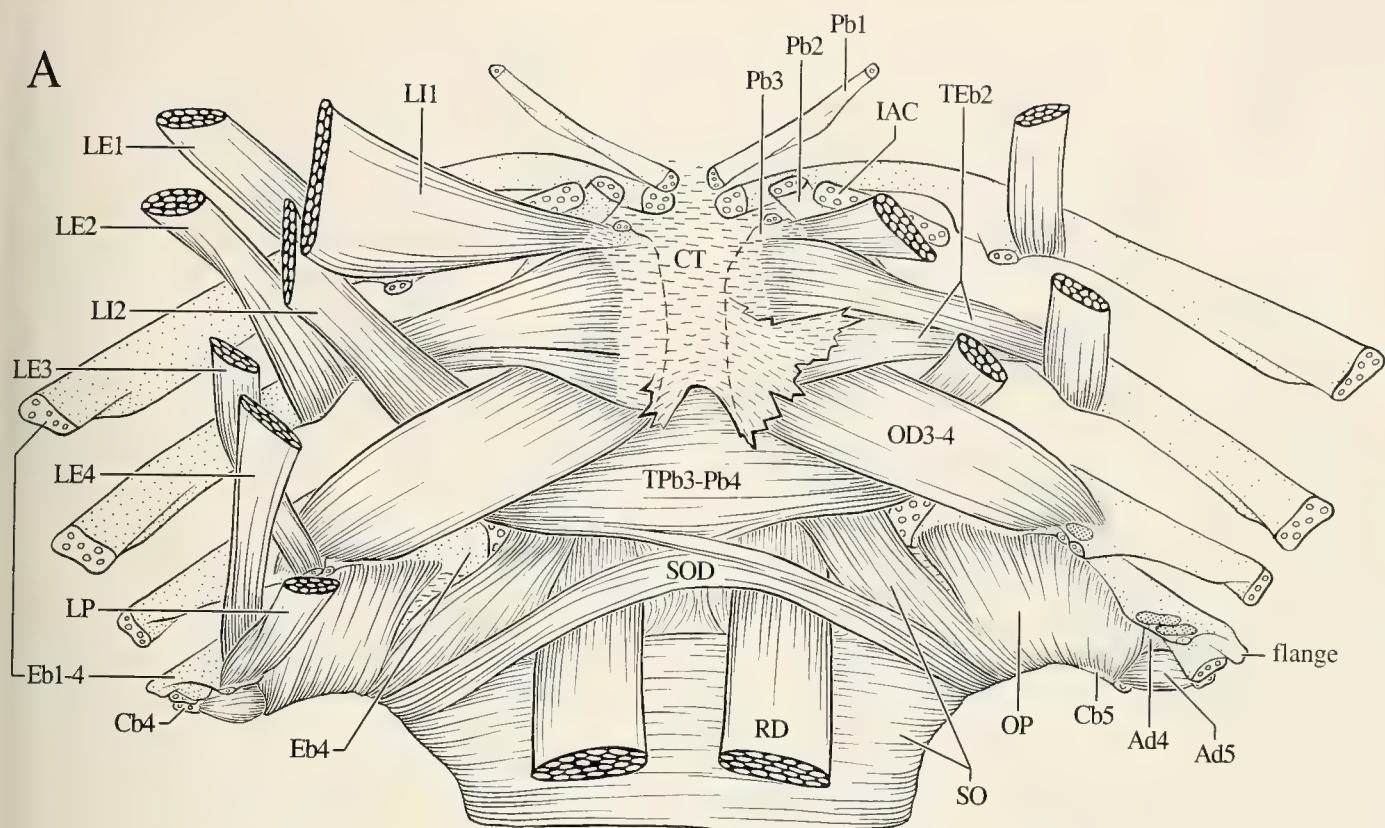


Plate 133. *Gerres cinereus*, USNM 331928: A, dorsal view, right-side OD3-4 bisected, TEb2 cut away, and LI2 removed (insertion obscured by medial end of Eb3). B, posterior view, left side.





***Gramma***  
(Grammatidae)

Plate 134. *Gramma loreto*, USNM 360170: A, dorsal view, right-side LE3, LE4 and LP removed (insertion positions indicated by shading). B, posterior view: straightforward.





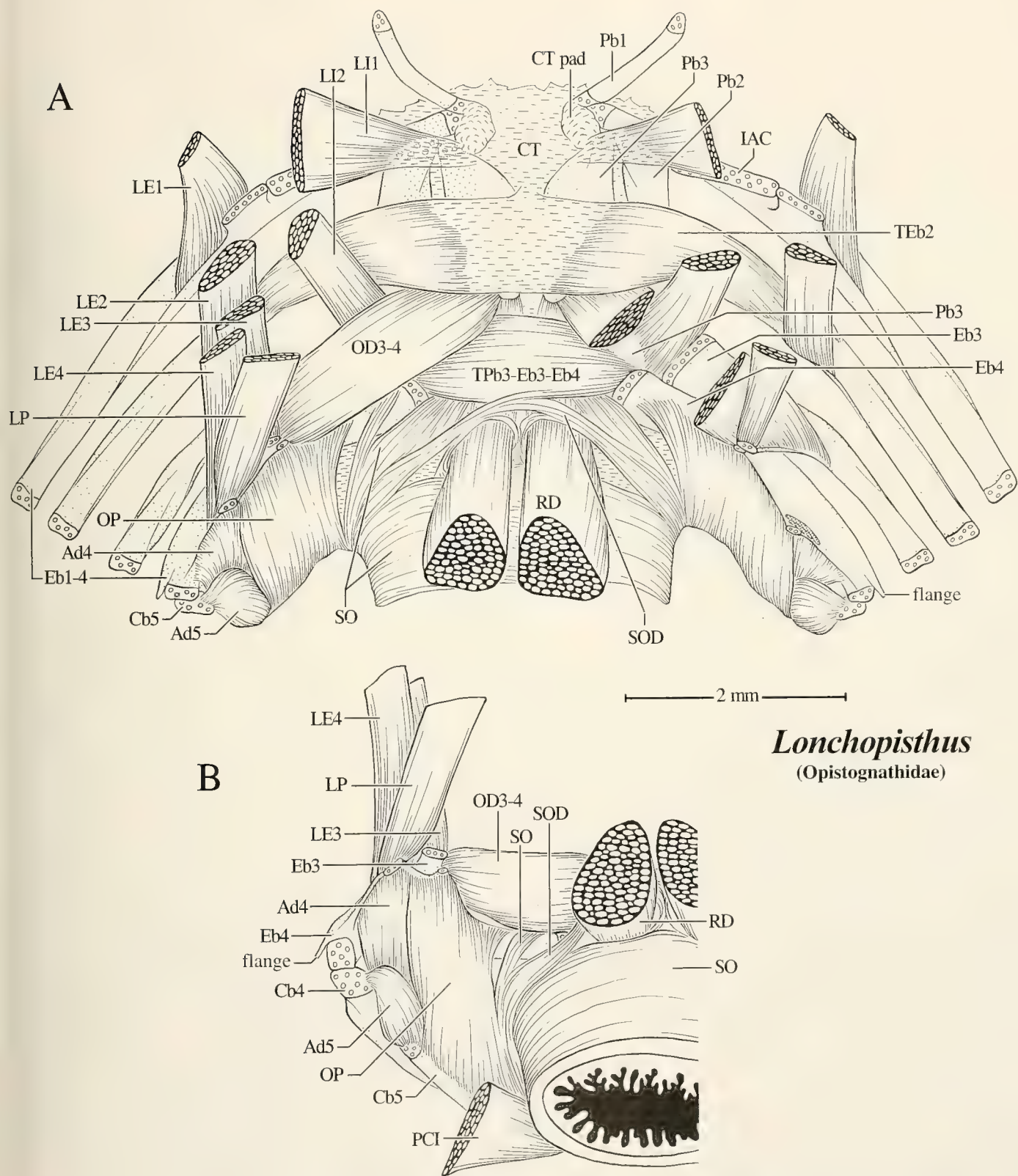
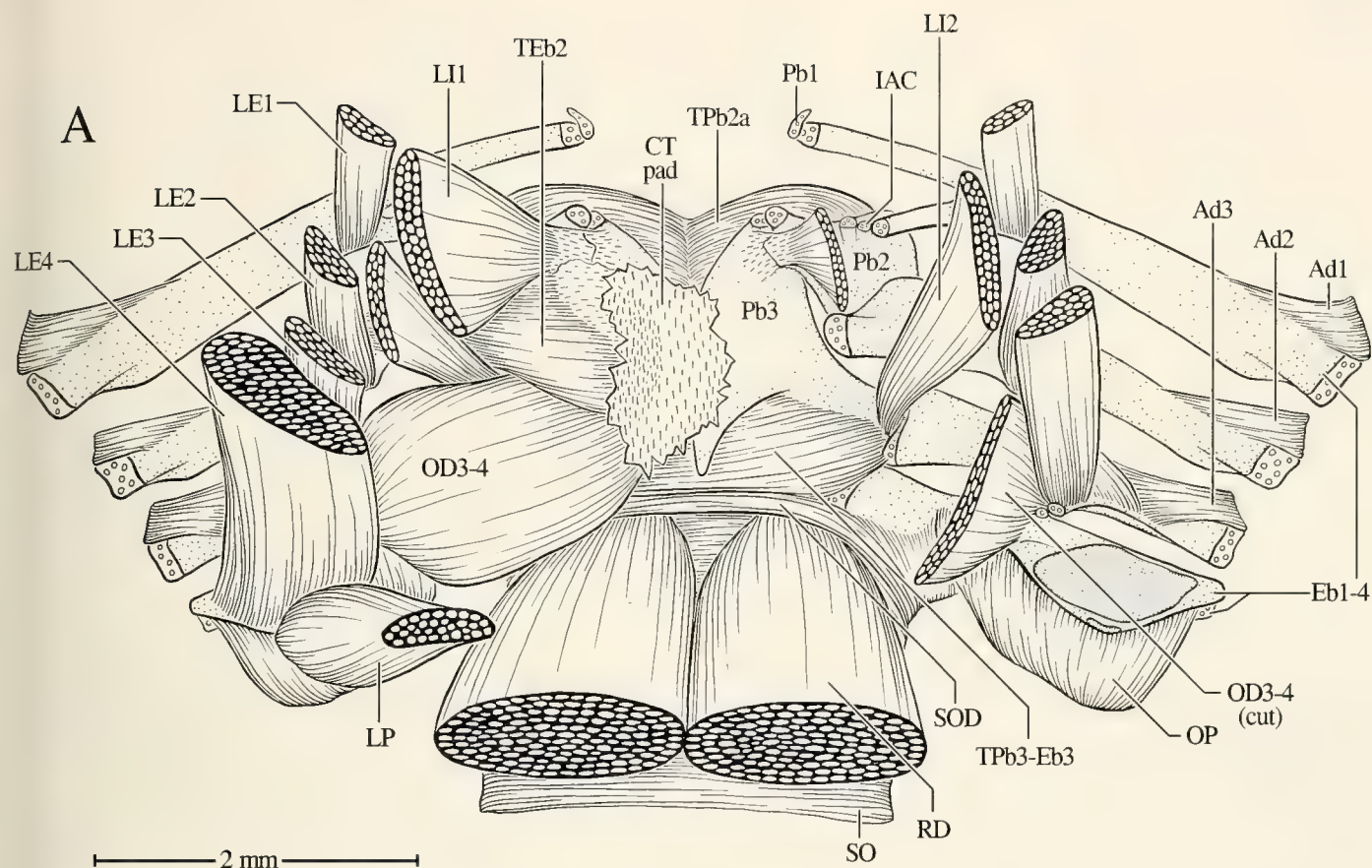


Plate 135. *Lonchopisthus higmani*, USNM 186058: A, dorsal view, right-side LE4 and LP removed (insertion positions indicated by shading) and OD3-4 cut away to reveal underlying muscle attachments. B, posterior view, left side.





***Labracinus***  
(Pseudochromidae)

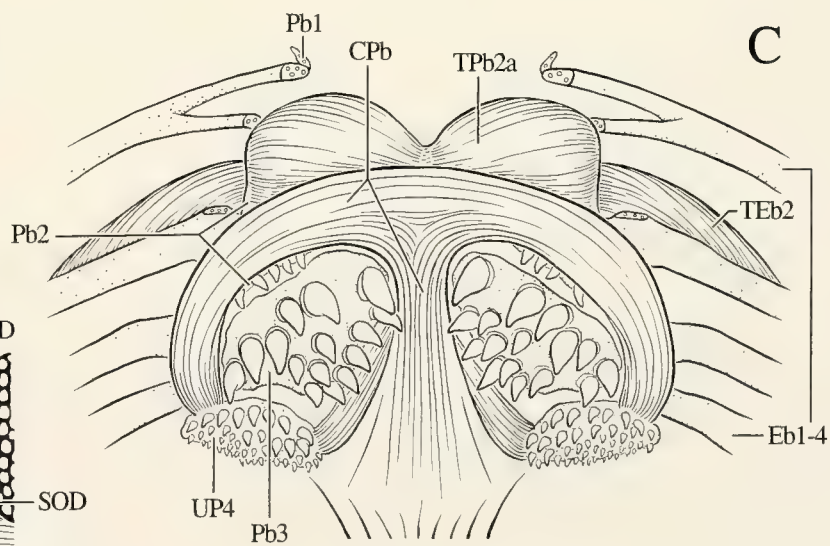
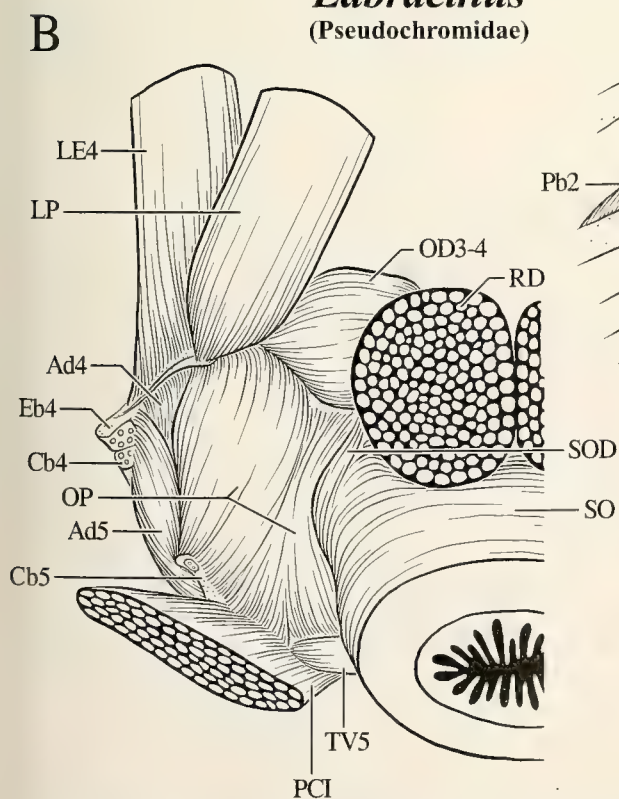


Plate 136. *Labracinus cyclophthalmus*, USNM 290900: A, dorsal view, right-side TEb2 removed, LE4 and LP removed (insertion positions indicated by shading), OD3-4 cut away, LI1 much truncated. B, posterior view, left side. C, pharyngeal area, ventral view, pharyngeal roof CT removed to expose CPb.





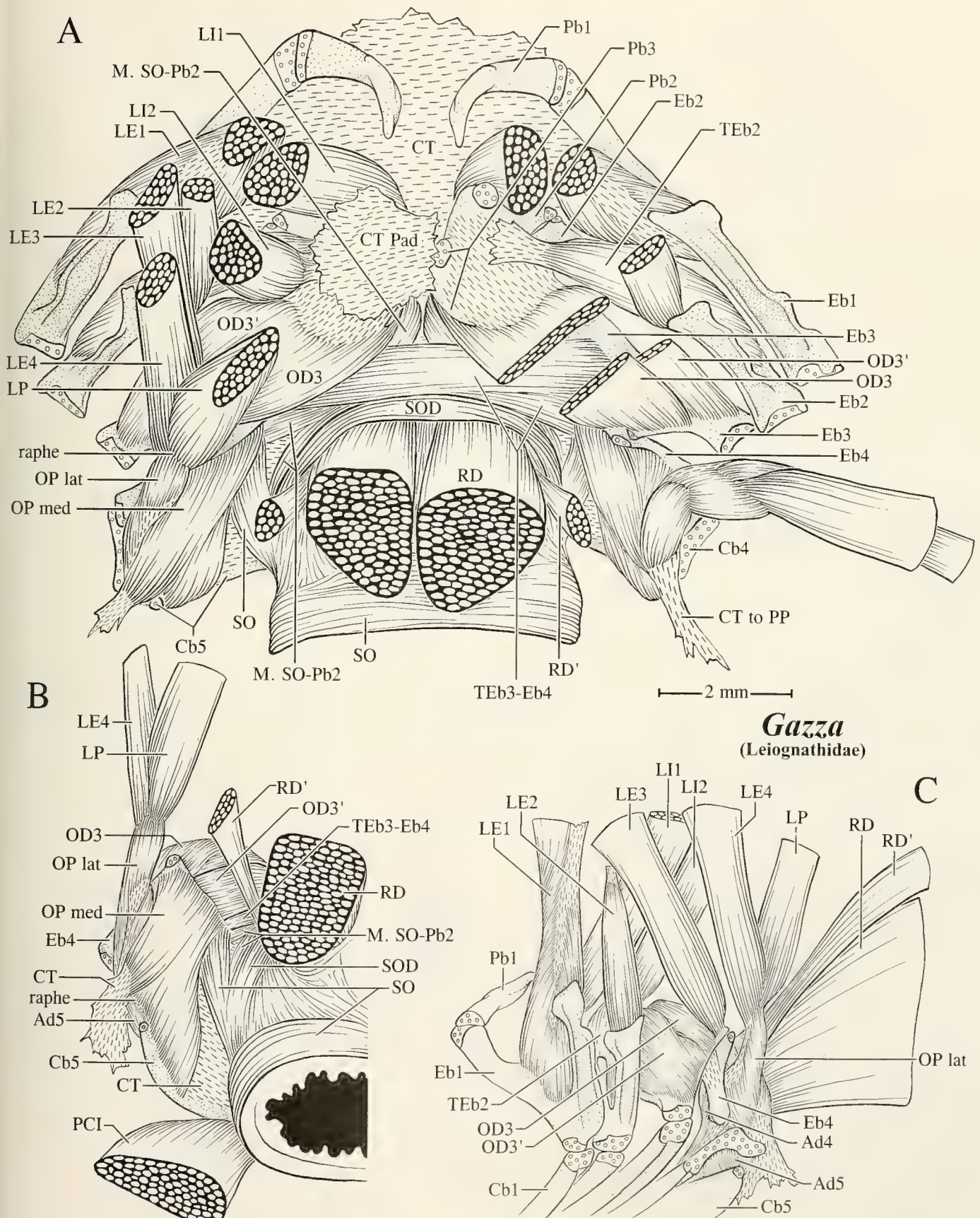


Plate 137. *Gazza* sp., USNM 268914: A, dorsal view, right-side CT pad removed, medial attachment of TEb2 to pad released, OD3-3' bisected, LE3 removed, LE4+LP forced ventrolaterally. B, posterior view, left side. C, lateral view, left side.





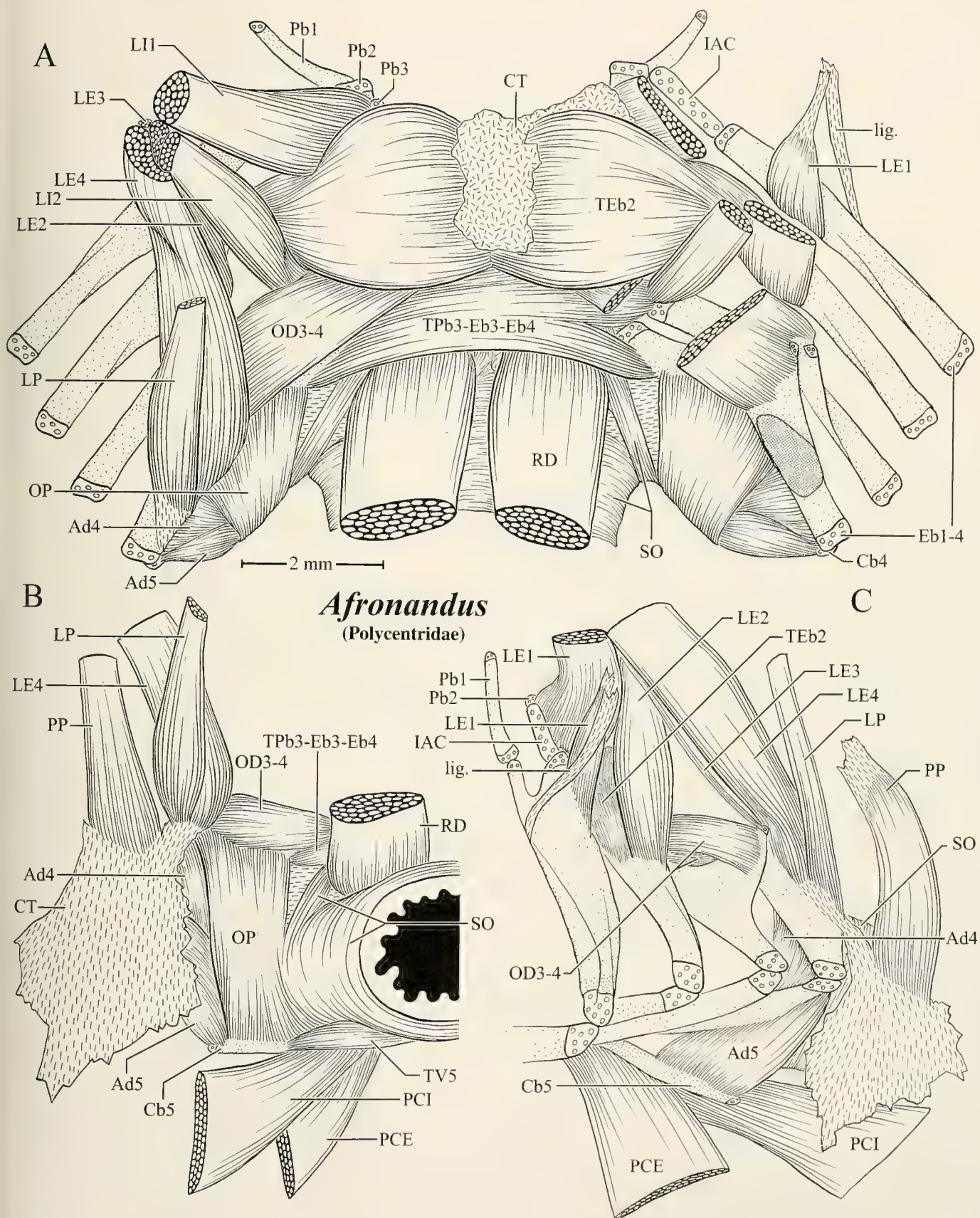


Plate 138. *Afromandus sheljuzhkoii*, USNM 372183: A, dorsal view, right-side LE4 and LP removed (insertion positions indicated by shading), OD3-4 bisected, LE3 truncated; anterior arm of Eb1, which articulates with Pb1 occluded from view on both sides. B, posterior view, left side. C, lateral view, left side, most levators truncated.





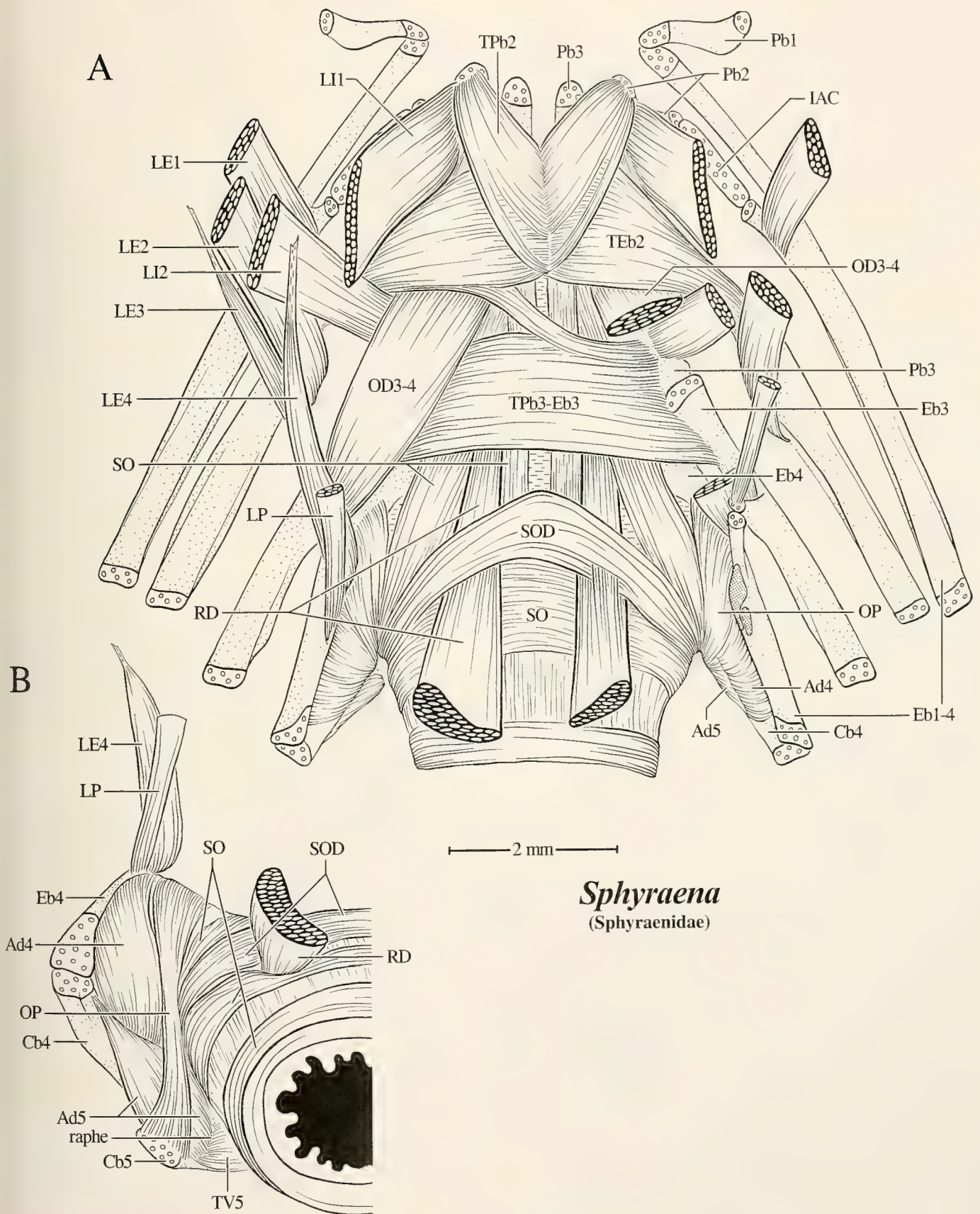
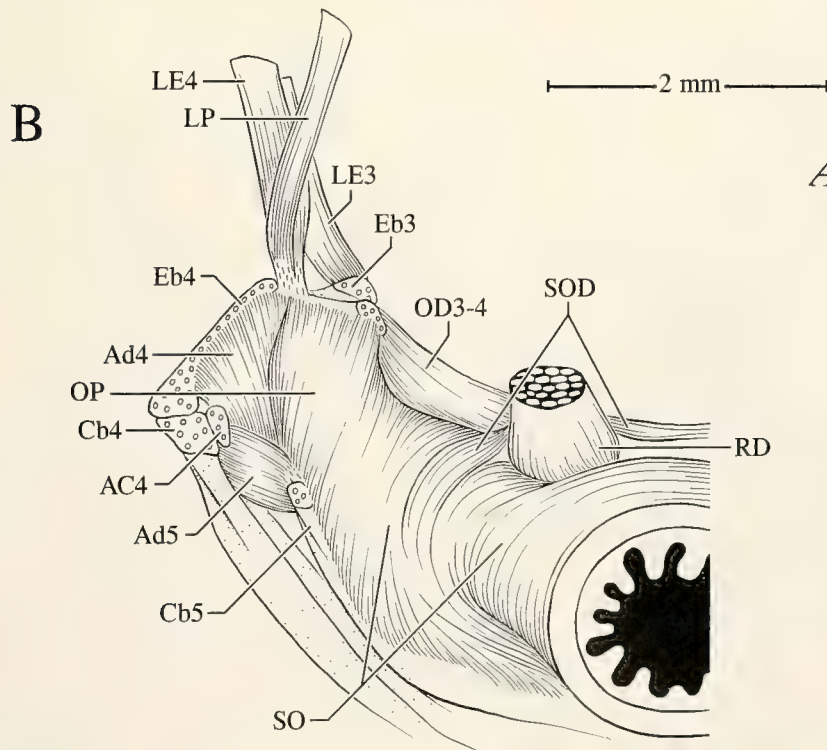
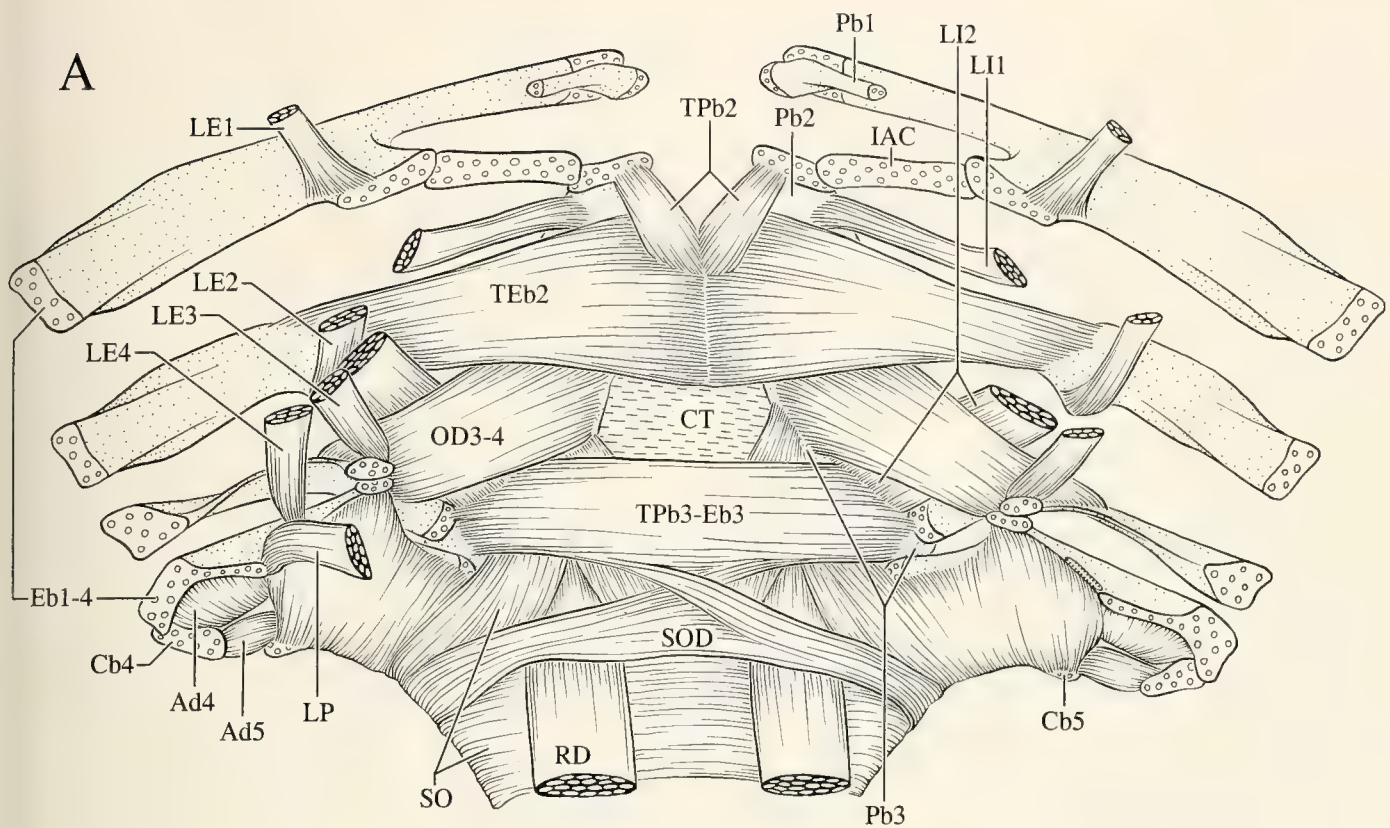


Plate 139. *Sphyraena barracuda*, USNM 331677: A, dorsal view, right-side OD3-4 bisected and LE4 and LP removed (insertion positions indicated by shading). B, posterior view, right side reversed.



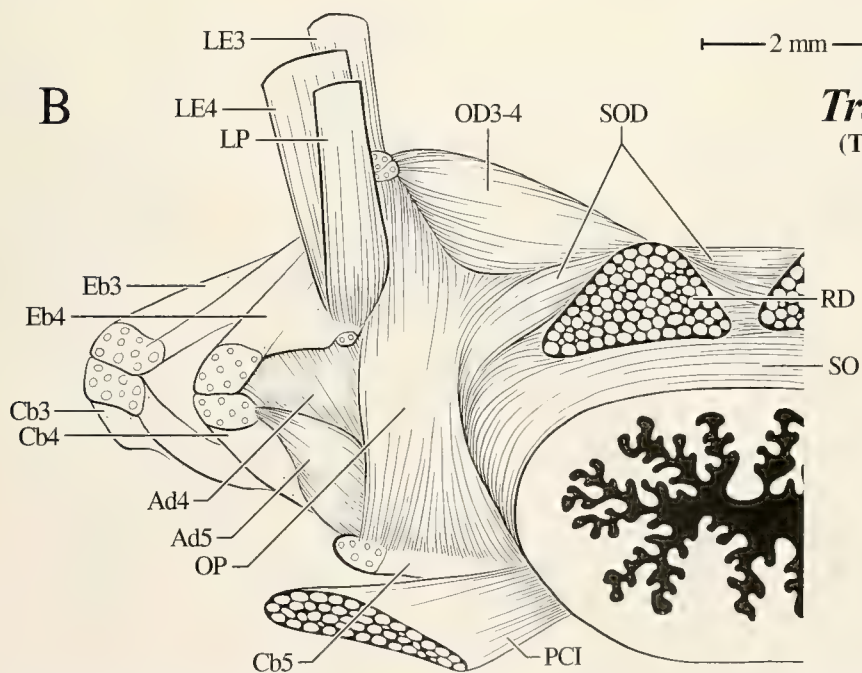
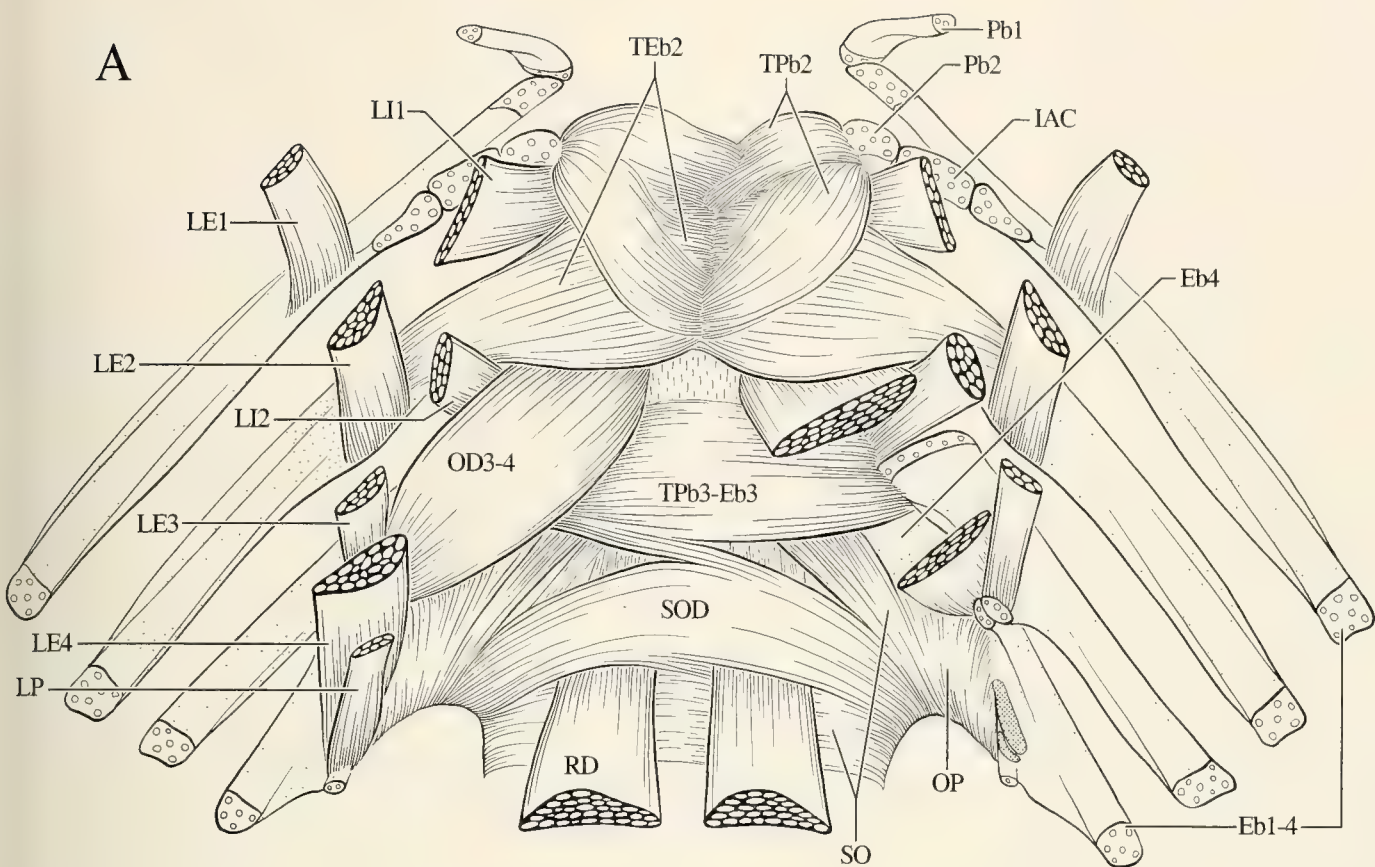


*Ammodytes*  
(Ammodytidae)

Plate 140. *Ammodytes dubius*, USNM 302478: A, dorsal view, right-side LE4 and LP removed (joint insertion position indicated by shading). B, posterior view, right side reversed.







***Trachinus***  
(Trachinidae)

Plate 141. *Trachinus draco*, USNM 349536: A, dorsal view, right-side OD3-4 bisected and LE4 and LP removed (insertion positions shaded); attachment of TPb3-Eb3 to Eb4 is anomalous (see remarks following TD in species description). B, posterior view, right side reversed.



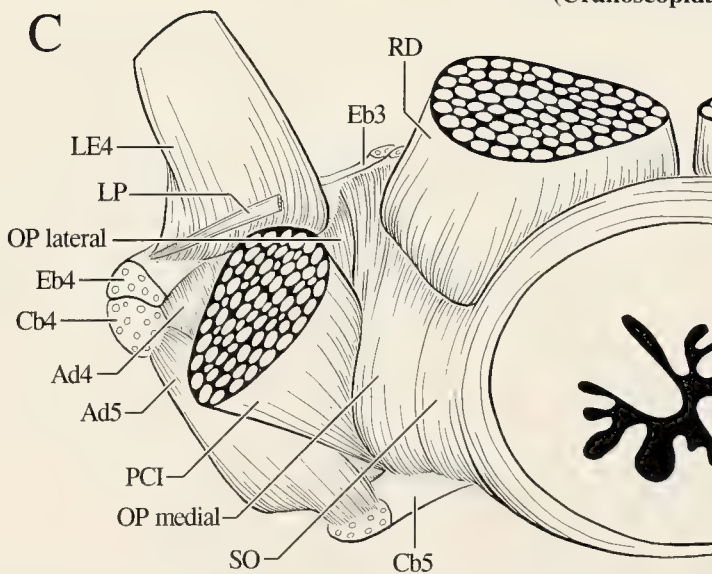
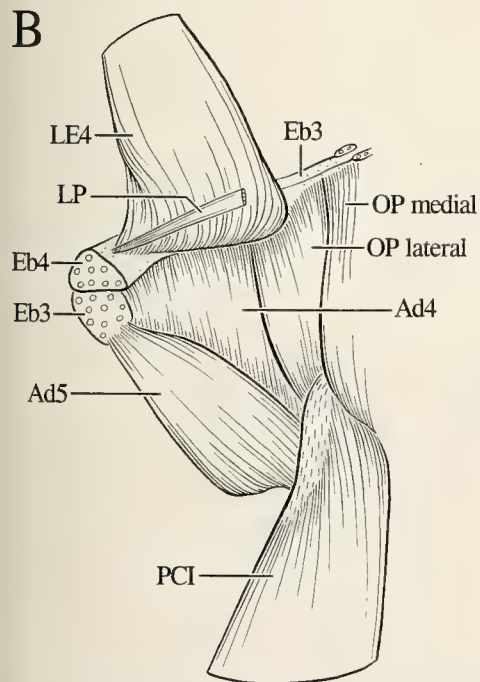
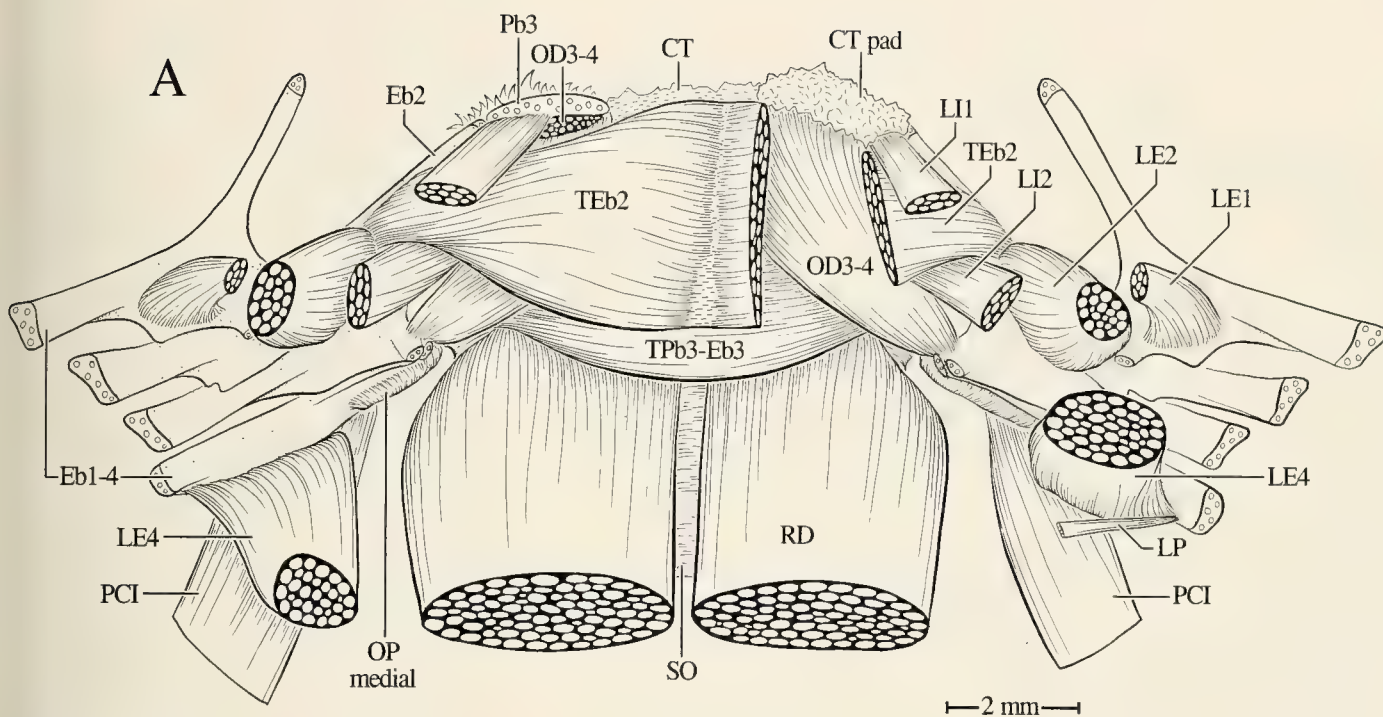


Plate 142. *Kathetostoma cubana*, USNM 187953: A, dorsal view, CT pad covering TD removed, left-side LE4 retracted (obscuring LP), right-side of TEB2 bisected. B, partial posterior view, left side with PCI retracted to show obscured muscles. C, posterior view left side.





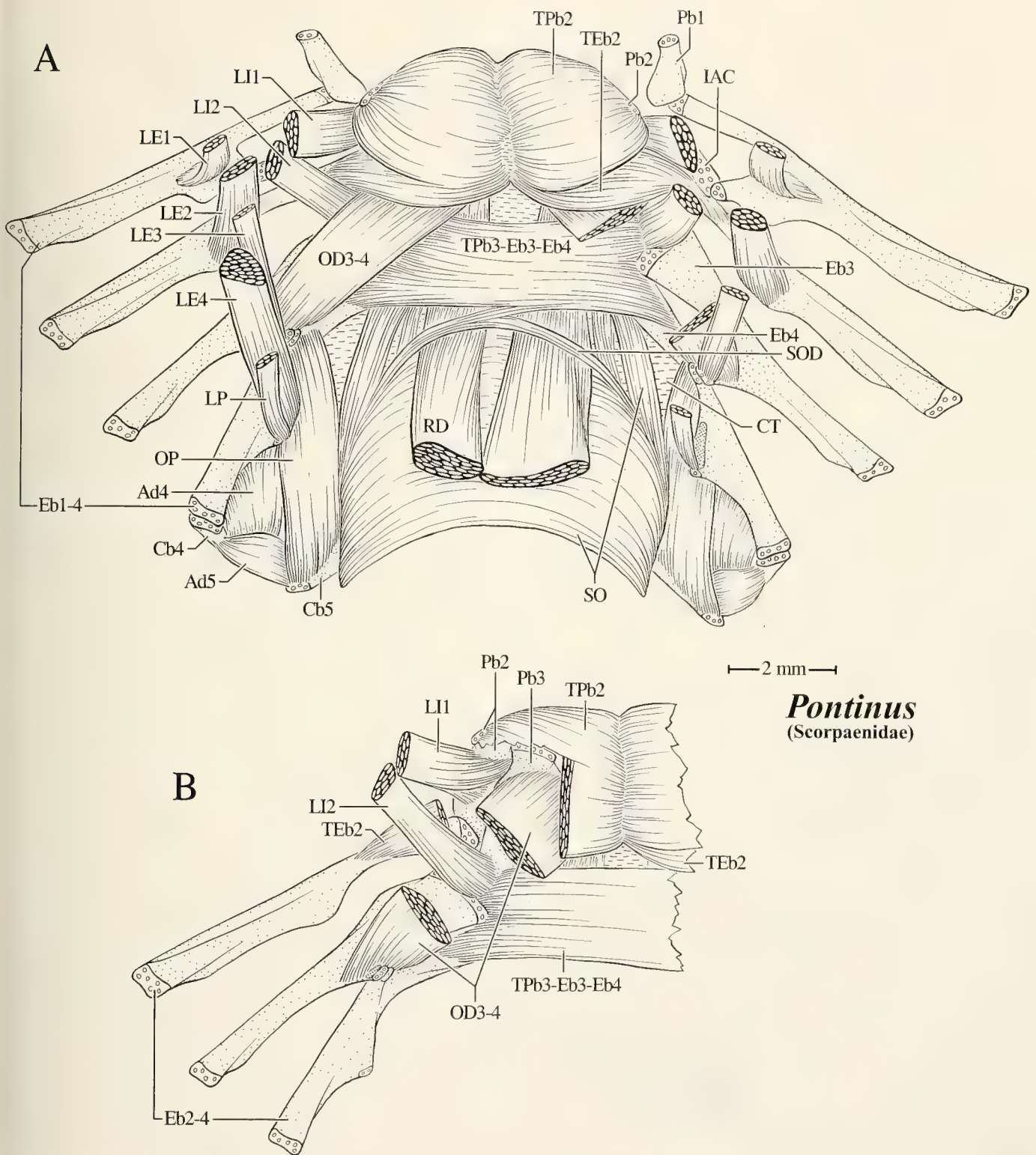
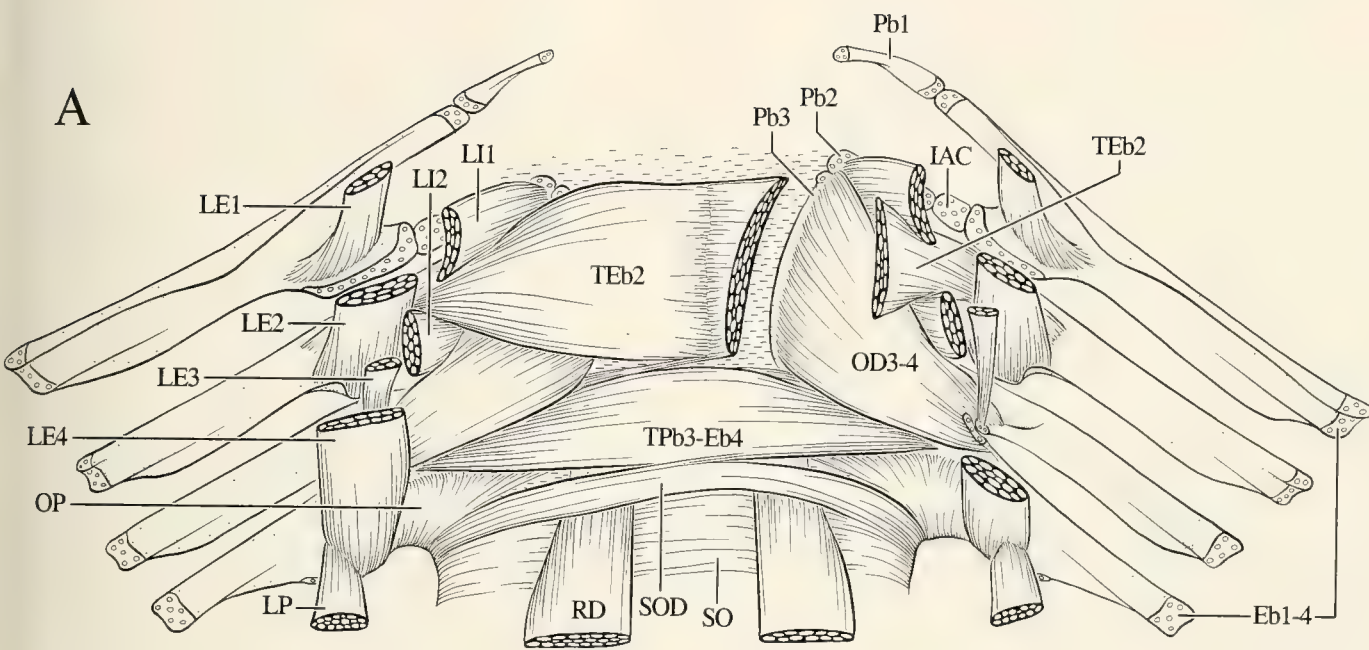


Plate 143. *Pontinus rathbuni*, USNM 190360: A, dorsal view, right-side LE4 removed (insertion position indicated by shading) and OD3-4 bisected. B, dorsoanteriorolateral view, left side: Eb1 removed, LE2-4 removed, and TEB2, TPb2, and OD3-4 cut away to show LI1, LI2, and TPb3-Eb3-Eb4 insertions).





— 2 mm —

***Platycephalus***  
(Platycephalidae)

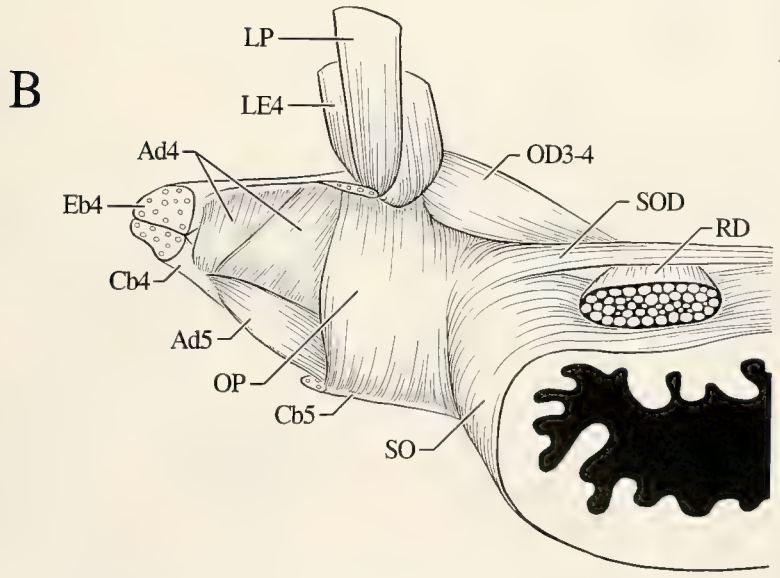
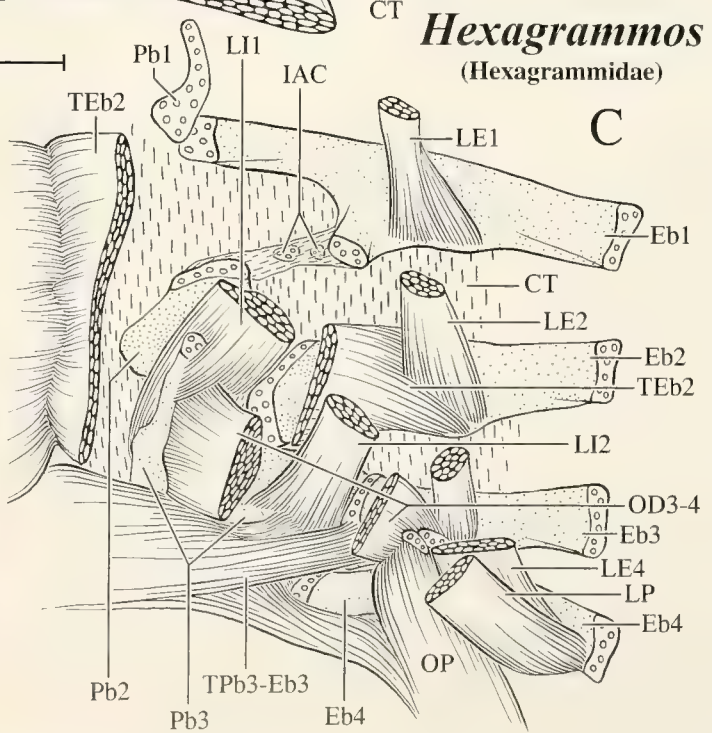
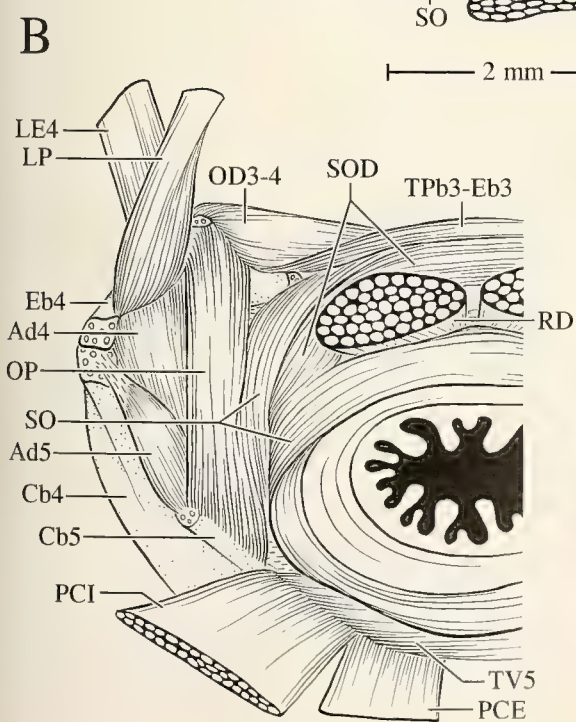
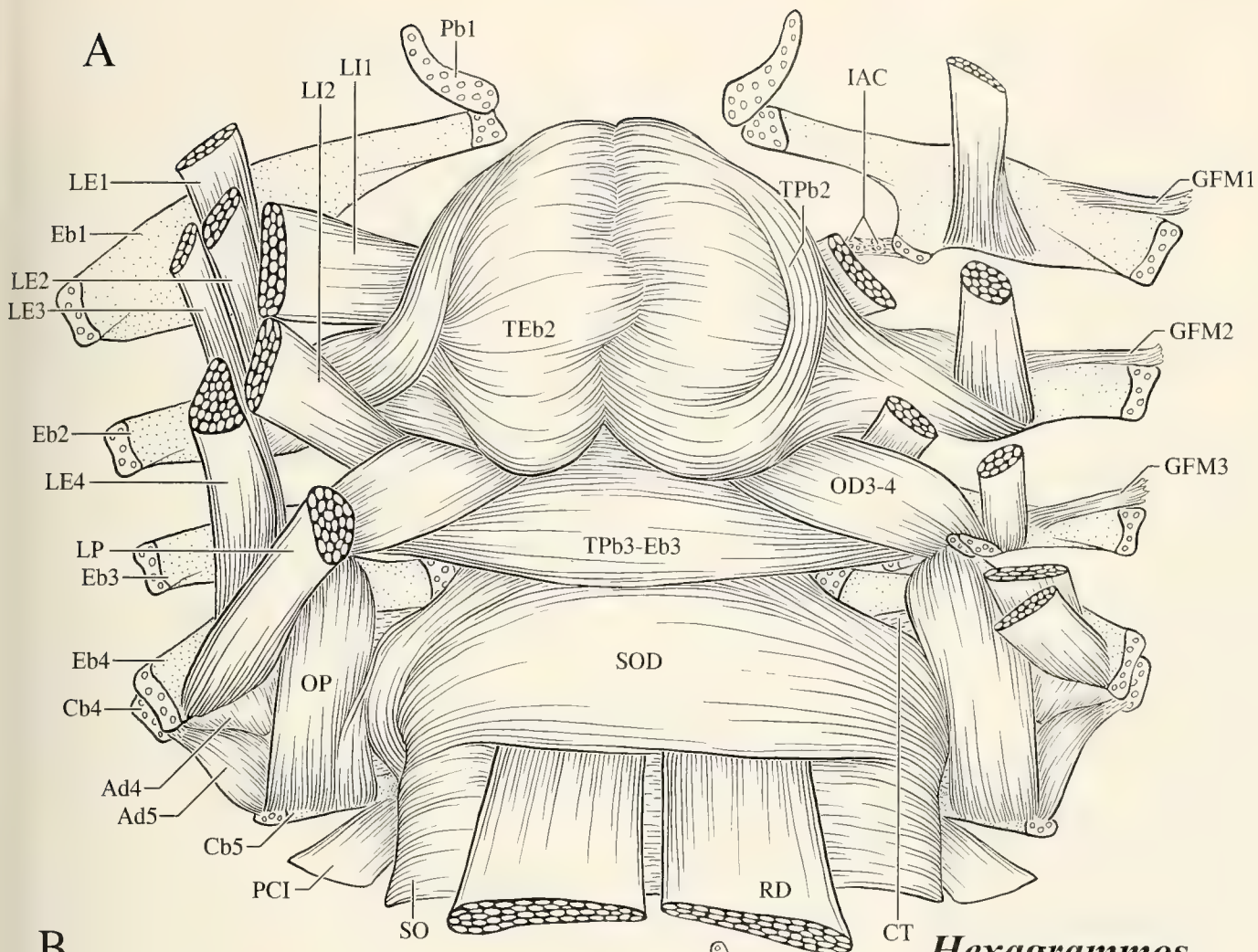


Plate 144. *Platycephalus endrachtensis*, USNM 173884: A, dorsal view, right side of TEb2 bisected. B, posterior view, left side.



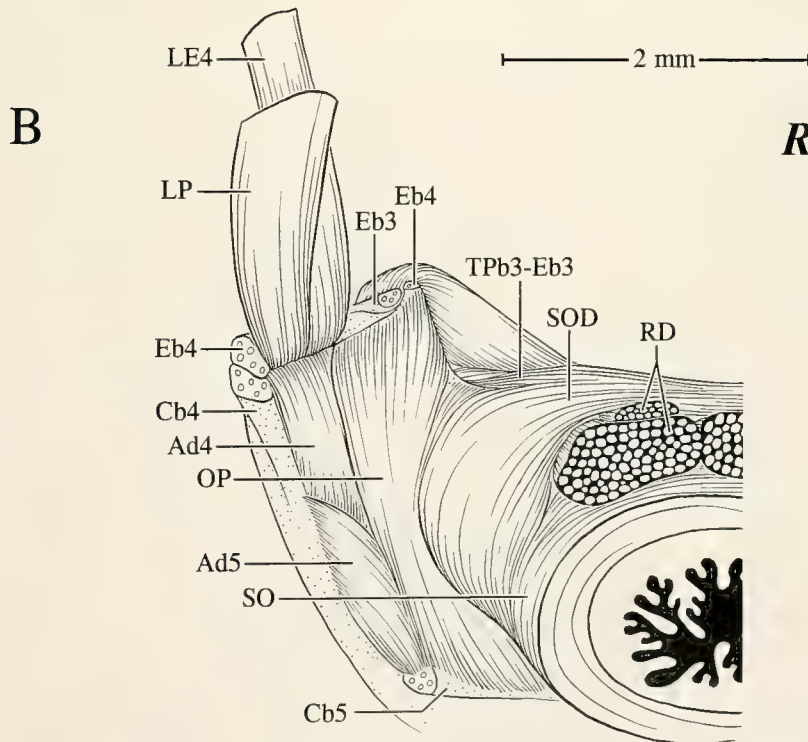
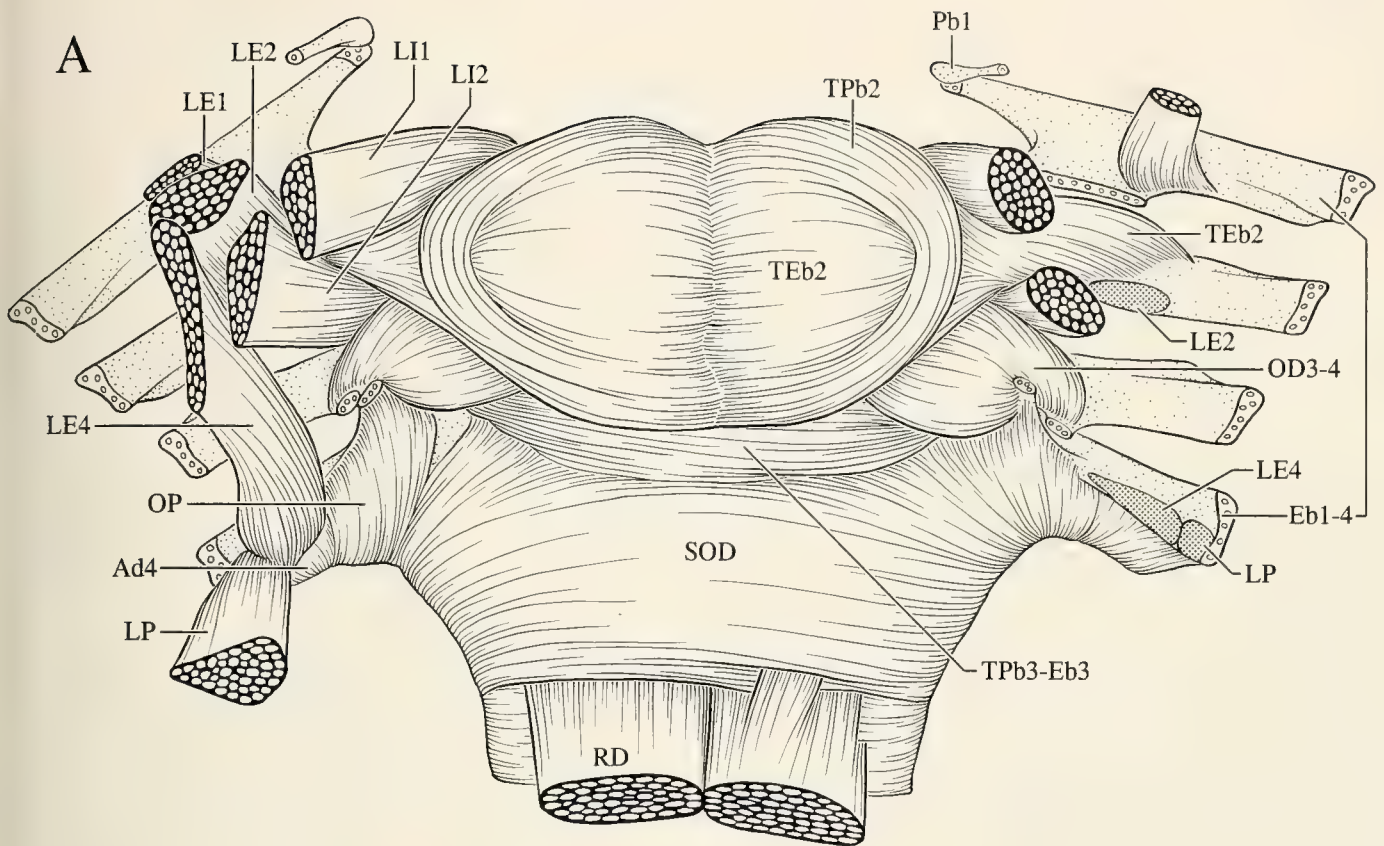




**Hexagrammos**  
(Hexagrammidae)

Plate 145. *Hexagrammos stelleri*, USNM 130279: A, dorsal view, left-side GFM1 removed, TPb2 aberrant. B, posterior view, left side. C, dorsal view, right side, TEb2 and OD3-4 bisected to expose underlying muscle insertions.





*Rhamphocottus*  
(Rhamphocottidae)

Plate 146. *Rhamphocottus richardsonii*, USNM 49141: A, dorsal view, right-side LE2, LE4, and LP removed (insertion positions indicated by shading); OD3' not visible. B, posterior view, right side reversed.





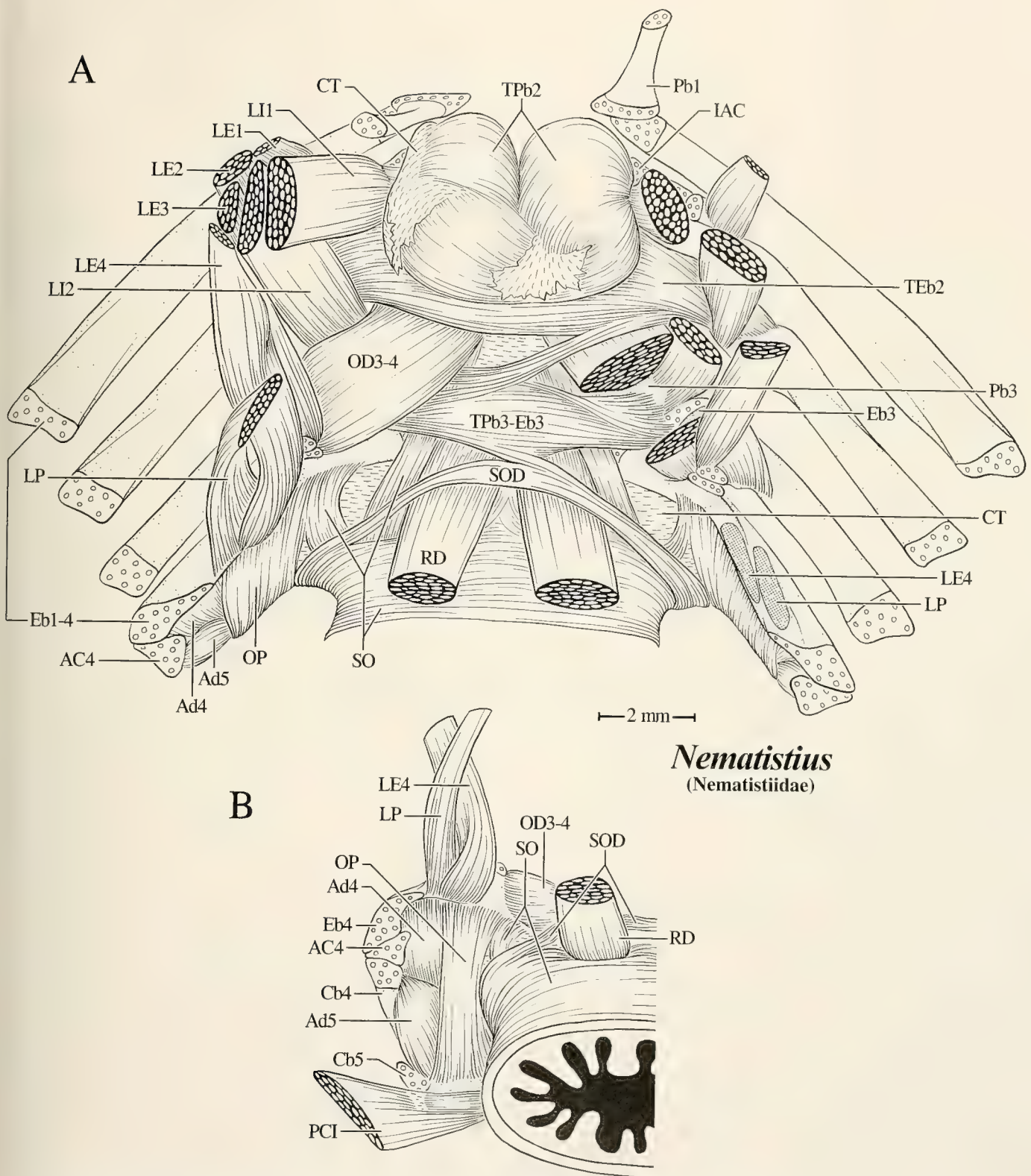
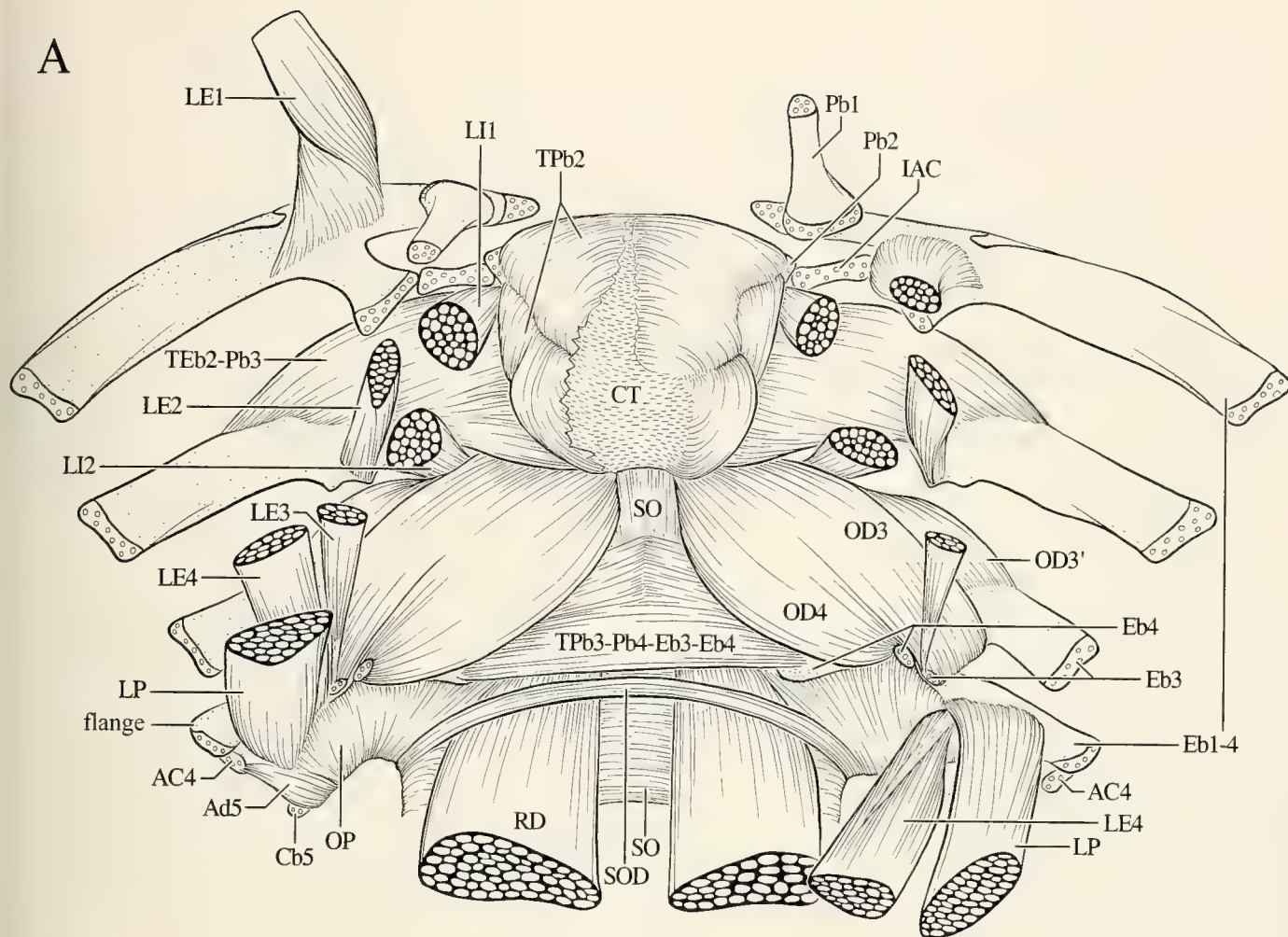


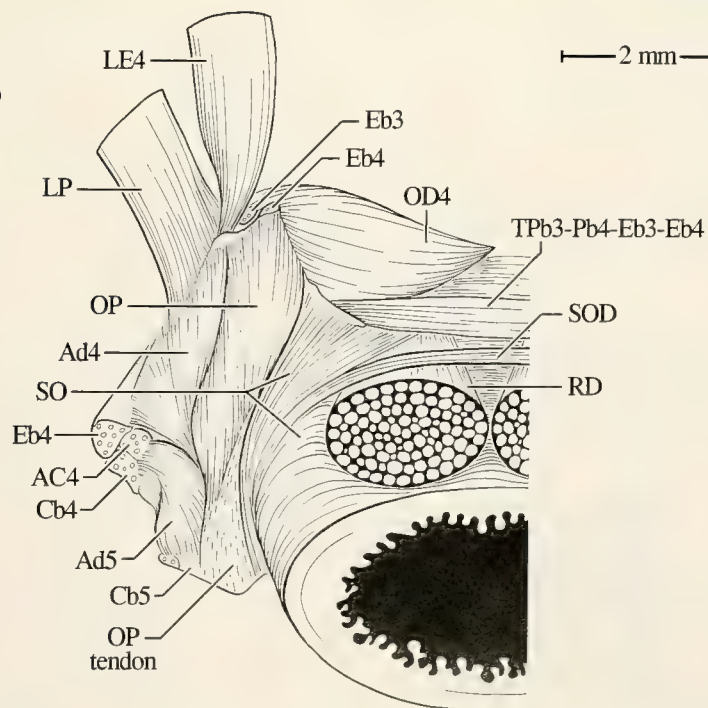
Plate 147. *Nematistius pectoralis*, USNM 82203: A, dorsal view, right-side Pb1 forced anteriorly, LE4 and LP removed (insertion positions indicated by shading), and OD3-4 cut away to reveal underlying muscle attachments. B, posterior view, left side.



A



B



*Selar*  
(Carangidae)

Plate 148. *Selar crumenophthalmus*, USNM 189251: A, dorsal view, left-side LE1 and right-side Pb1 forced anteriorly, right-side LP and LE4 forced posteriorly; OD3' not in view. B, posterior view, right side reversed; LP forced slightly laterally to reveal base of LE4.





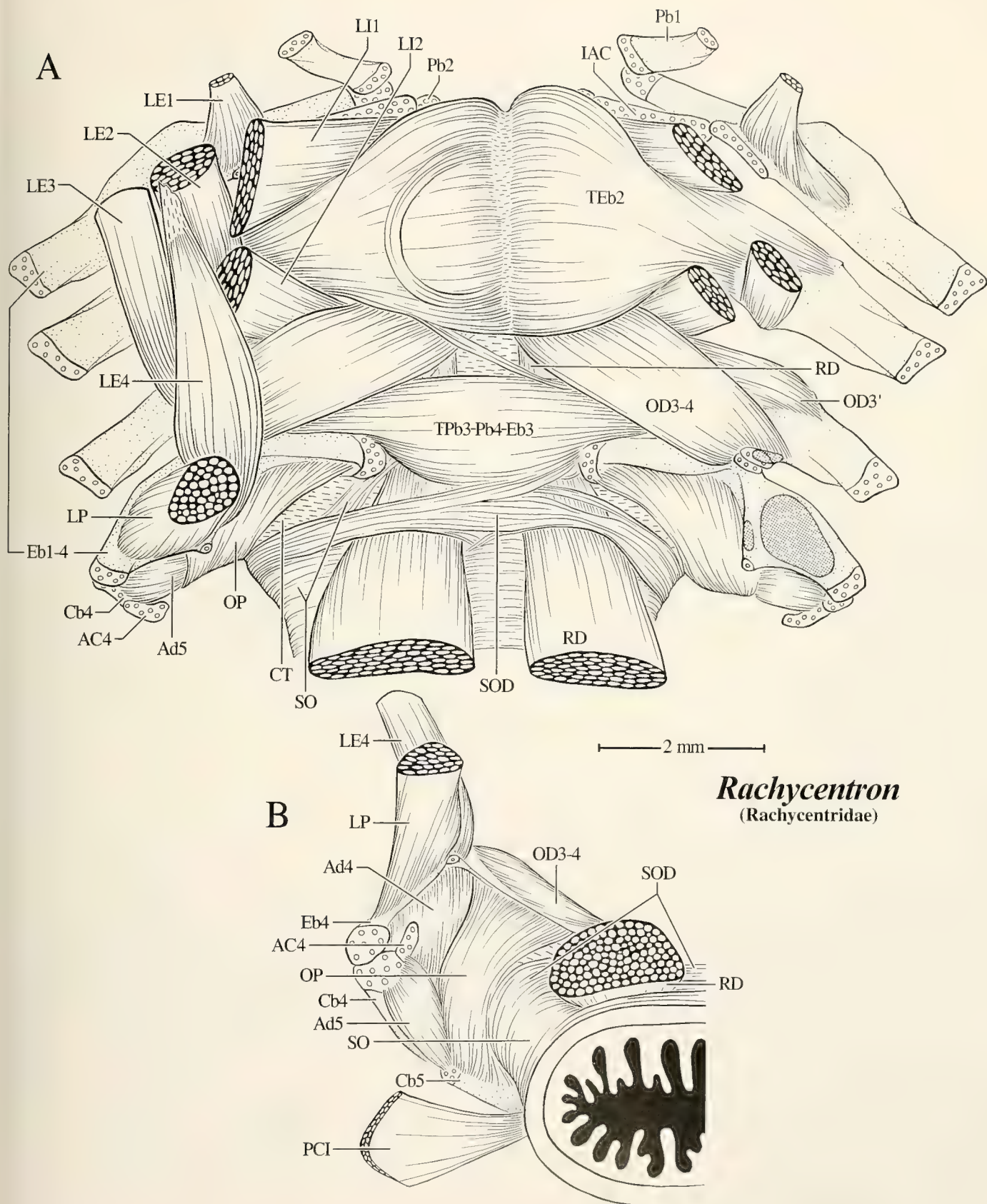


Plate 149. *Rachycentron canadum*, USNM 341455: A, dorsal view, right-side LE3, LE4, and LP removed (insertion positions indicated by shading); Left-side TPb2 vestigial (not labelled), right side absent. B, posterior view, left side.



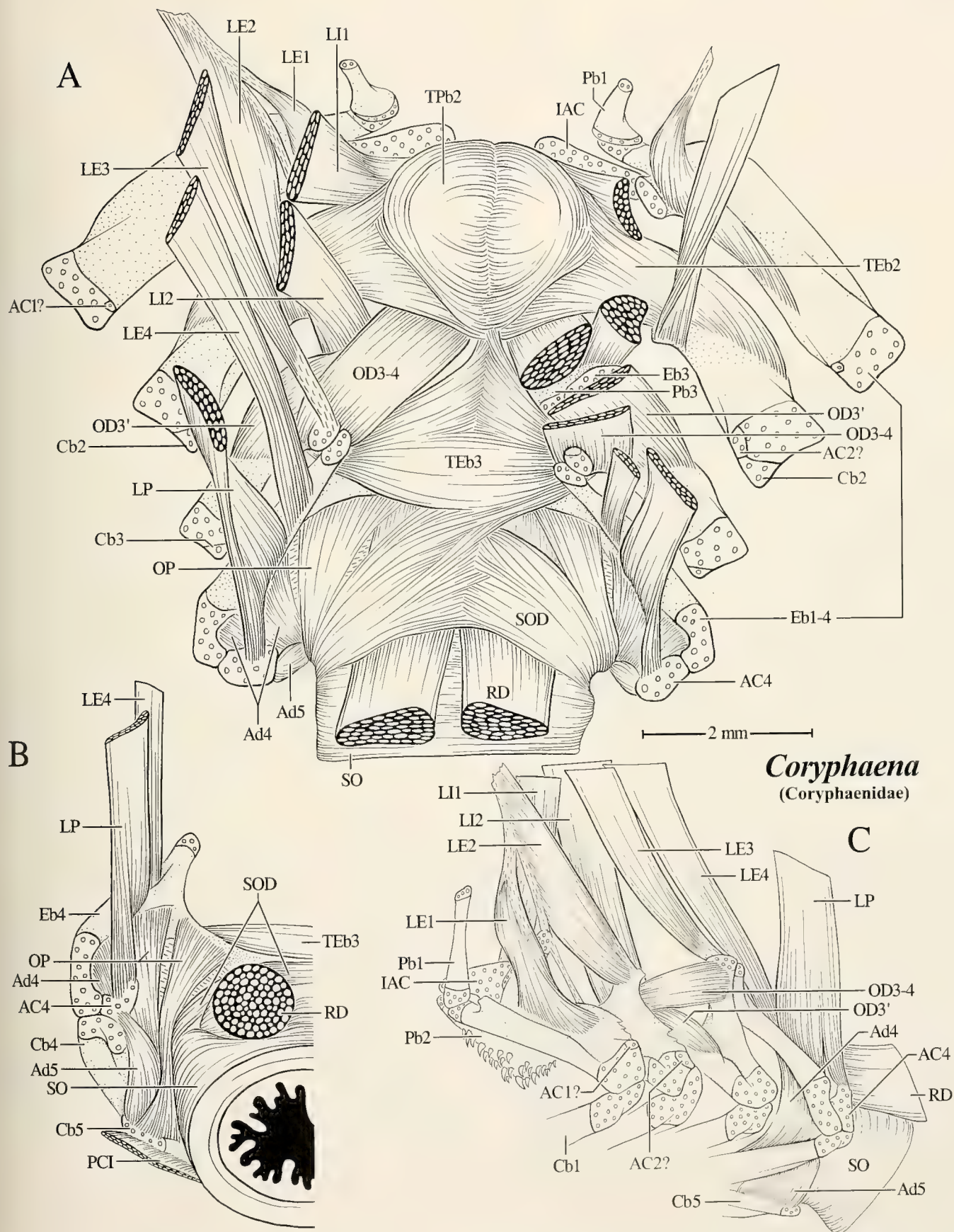


Plate 150. *Coryphaena equiselis*, USNM 158126: A, dorsal view, right-side OD3-4 and OD3' cut away to reveal insertion of LI2, LE3 removed, and tendinous connections between right-side LE1 and LE2 separated. B, posterior view, right side reversed. C, lateral view: left side.





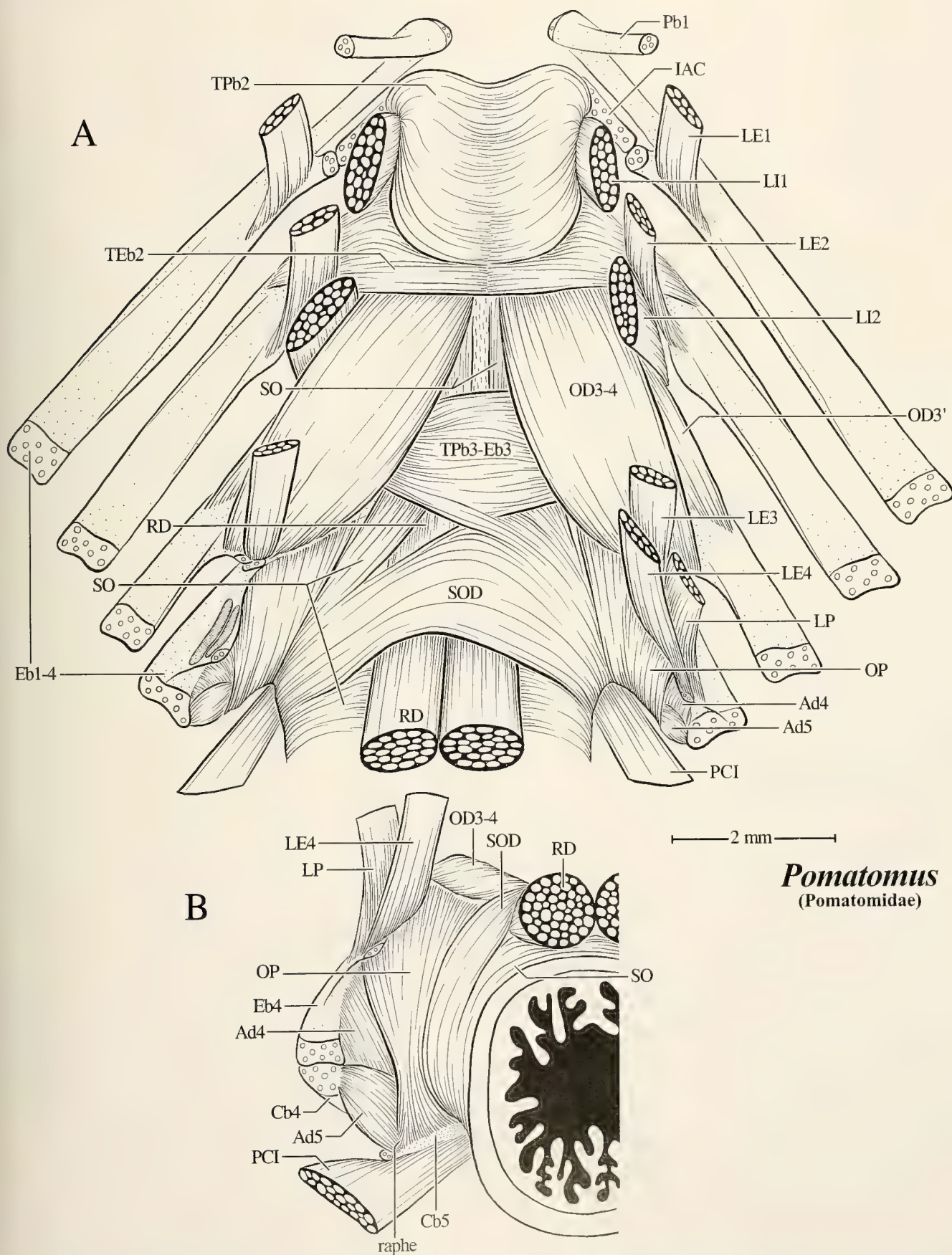


Plate 151. *Pomatomus saltatrix*, USNM 289926: A, dorsal view, left-side LE4 and LP removed (insertion positions indicated by shading). B, posterior view, right side reversed.



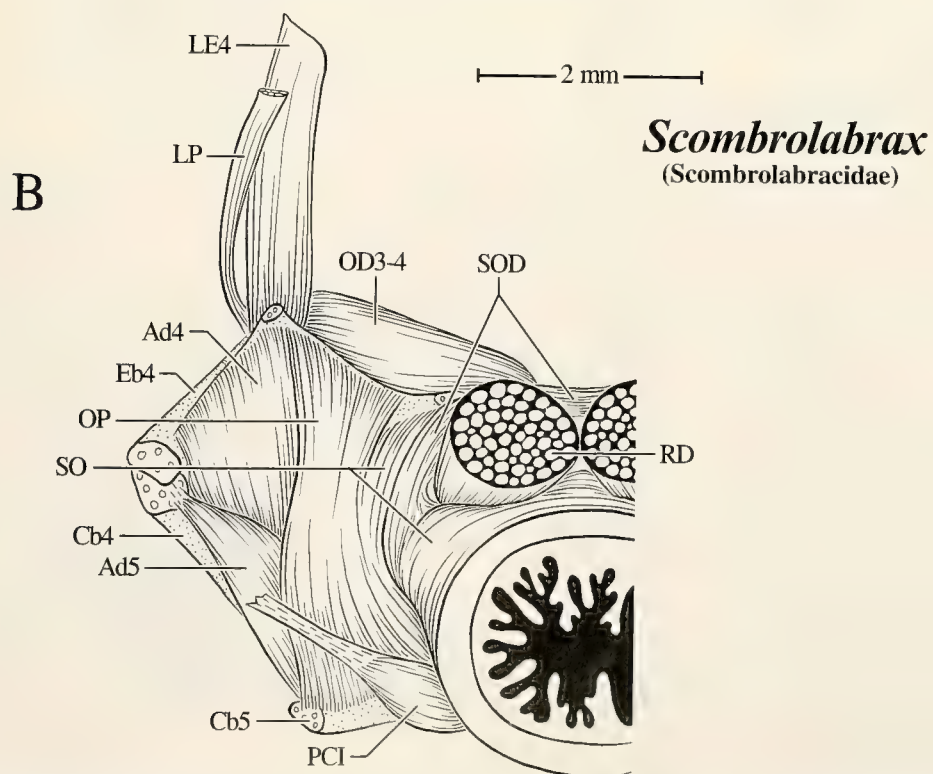
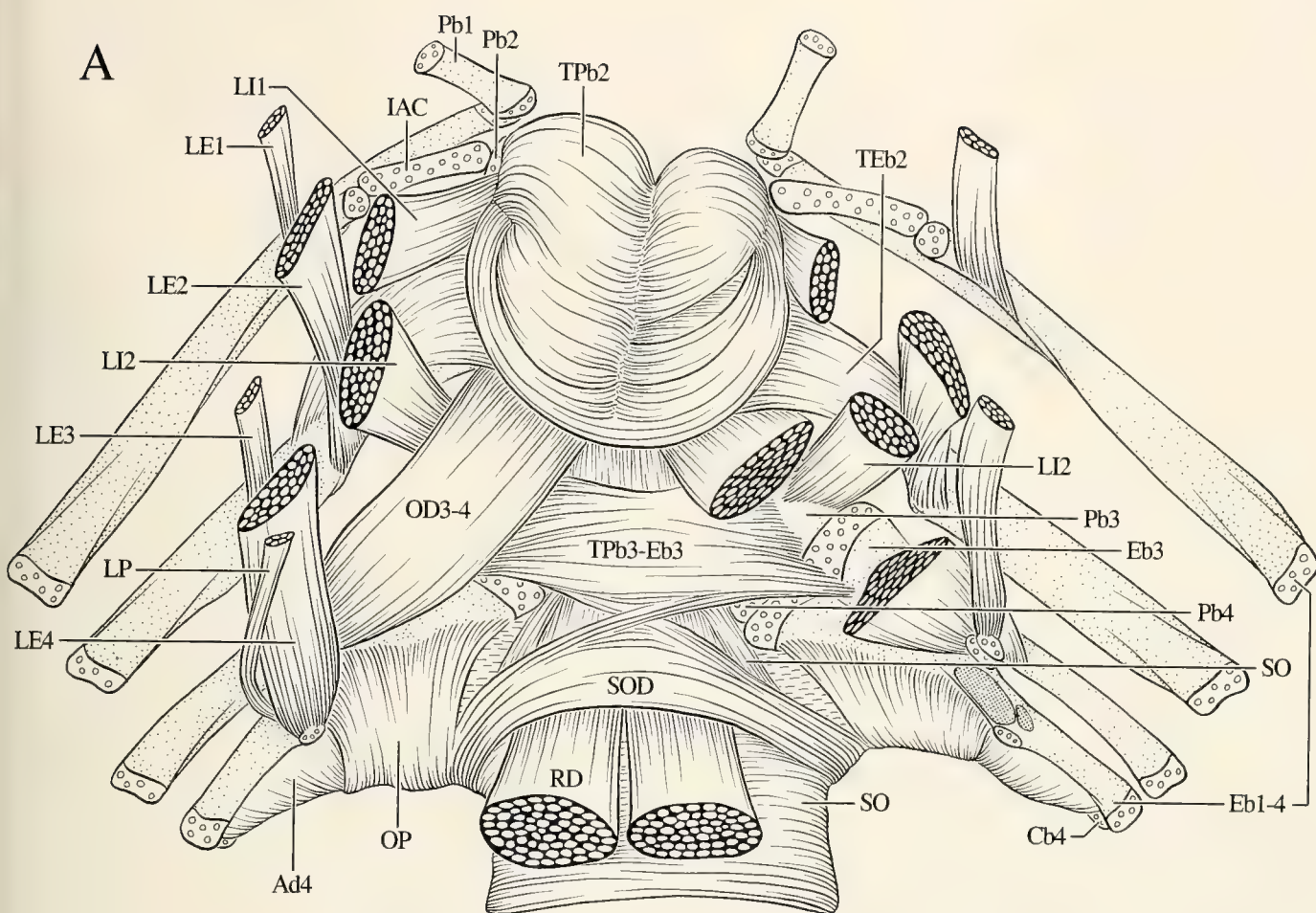


Plate 152. *Scombrolabrax heterolepis*, USNM 187651: A, dorsal view, right-side OD3-4 bisected and LE4 and LP removed (insertion positions indicated by shading). B, posterior view, left side.





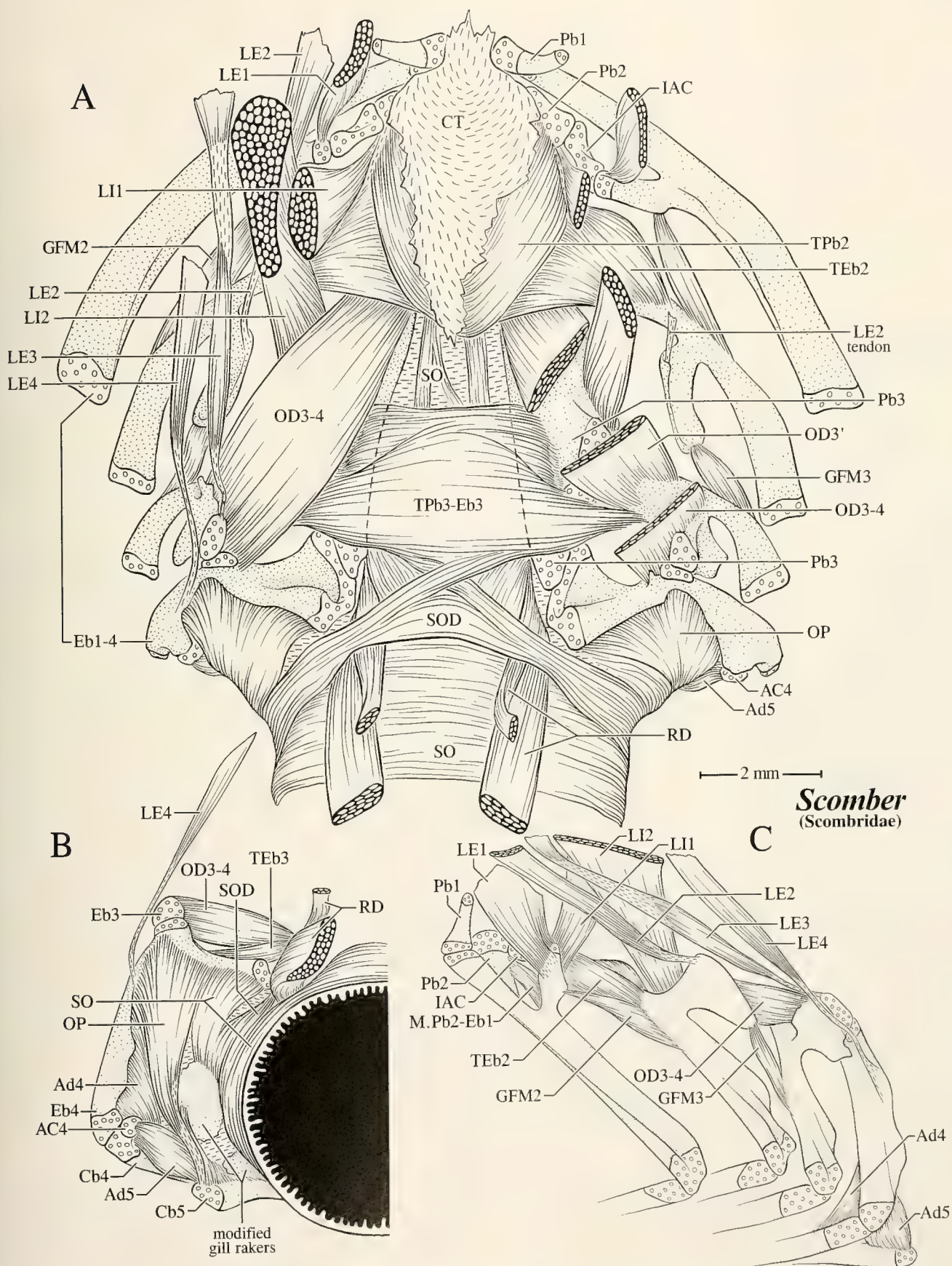
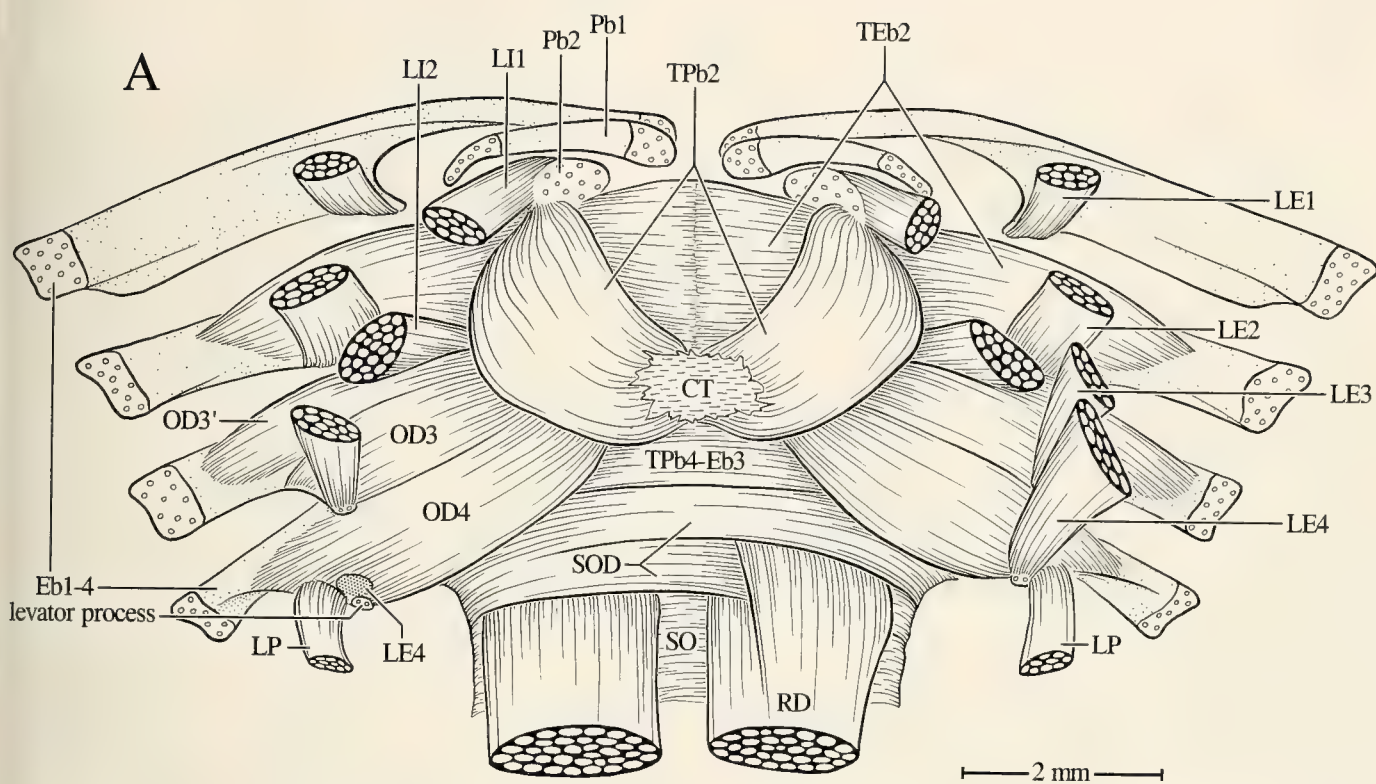


Plate 153. *Scomber scombrus*, USNM 203841: A, dorsal view, right-side LE2 greatly truncated, LE3 and LE4 removed, and OD3-4 and OD3' cut away (medial edge of Pb3 shown as dashed lines). B, posterior view, left side, LE3 removed. C, lateral view, right side reversed.





*Nemipterus*  
(Nemipteridae)

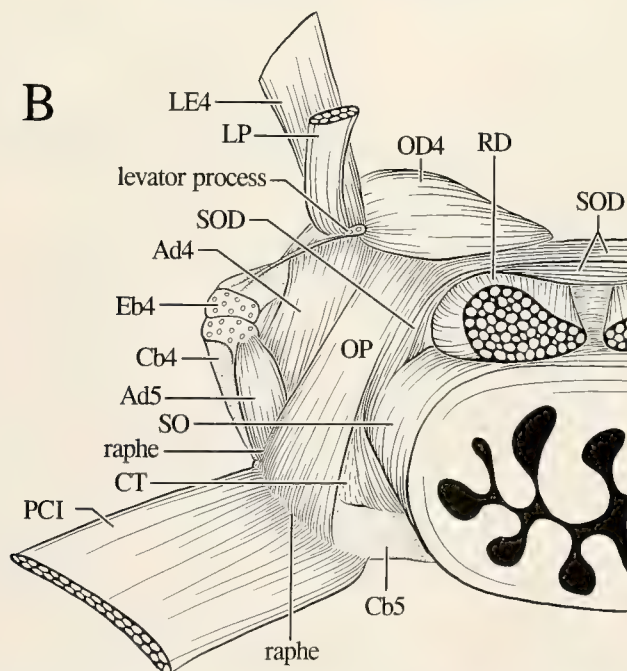
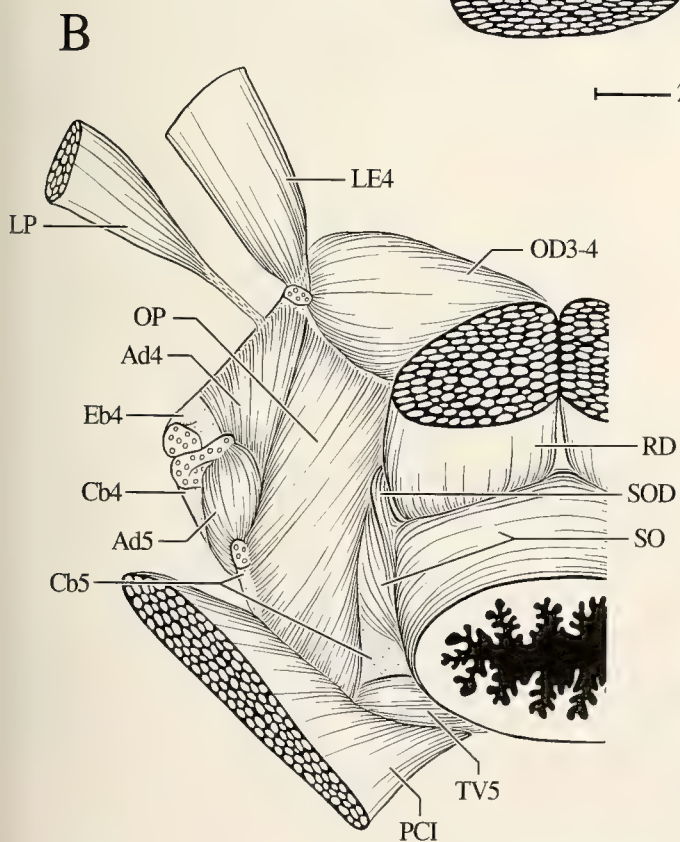
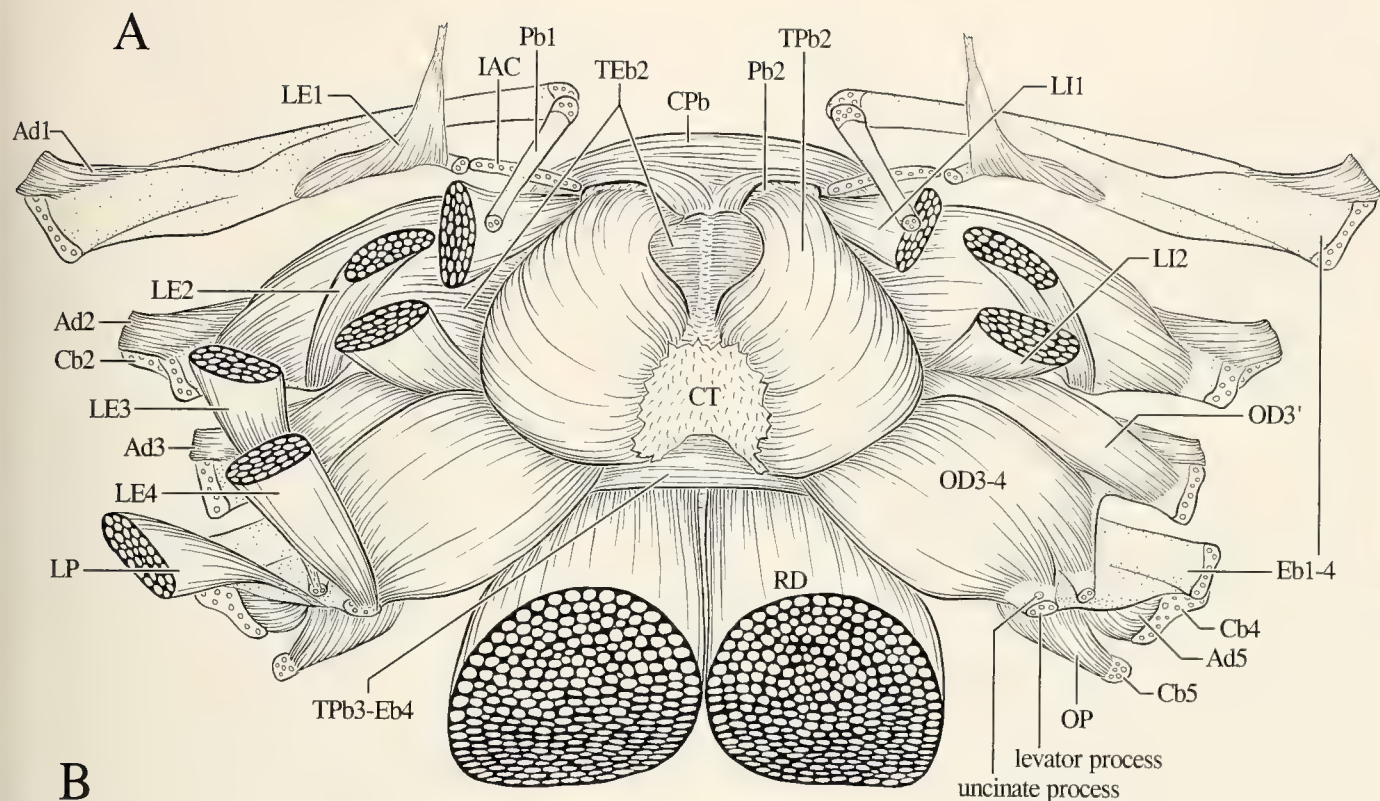


Plate 154. *Nemipterus furcosus*, USNM 349457: A, dorsal view, left-side LE4 removed (insertion position indicated by shading). B, posterior view, left side.







*Lethrinus*  
(Lethrinidae)

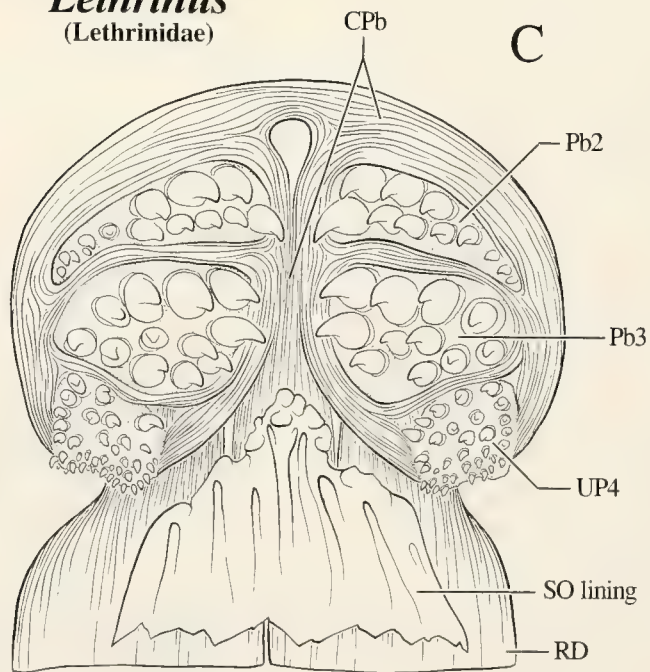
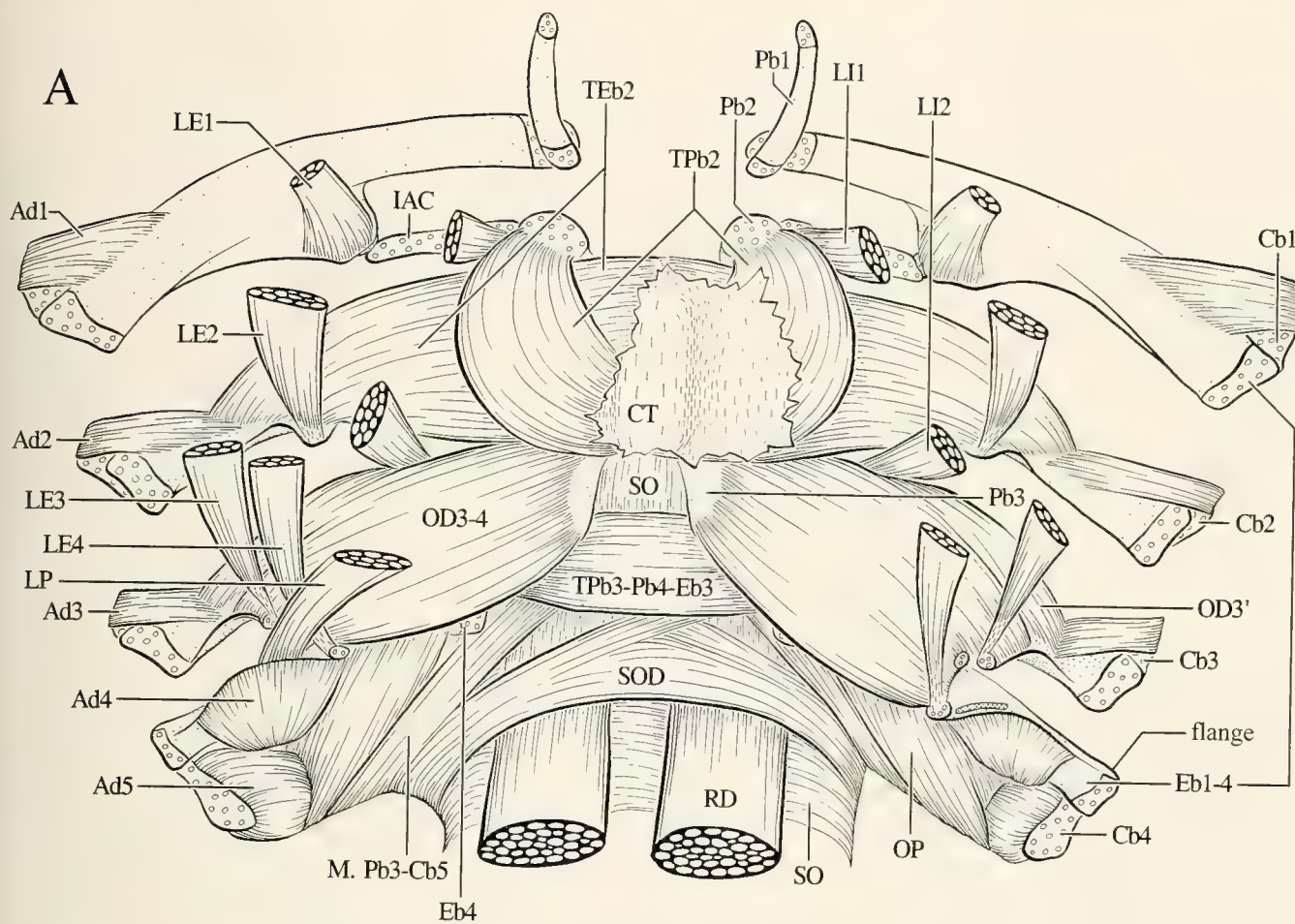


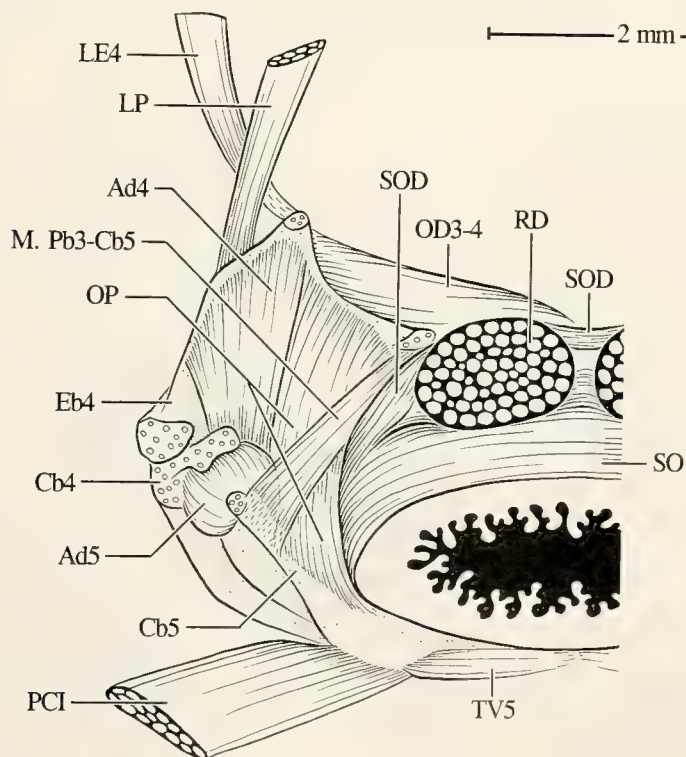
Plate 155. A, B, *Lethrinus obsoletus*, USNM 309317: A, dorsal view, right-side LE4 and LP removed (note position of tiny unlabelled Eb4 uncinat process anterior to levator process). B, posterior view left side. C, *Lethrinus harak*, USNM 259390: ventral view, pharyngeal area, roof CT removed to reveal CPb.





2 mm

B



*Spicara*  
(Centracanthidae)

Plate 156. *Spicara smaris*, USNM 269800: A, dorsal view, right-side LP removed (insertion position indicated by shading). B, posterior view, left side.





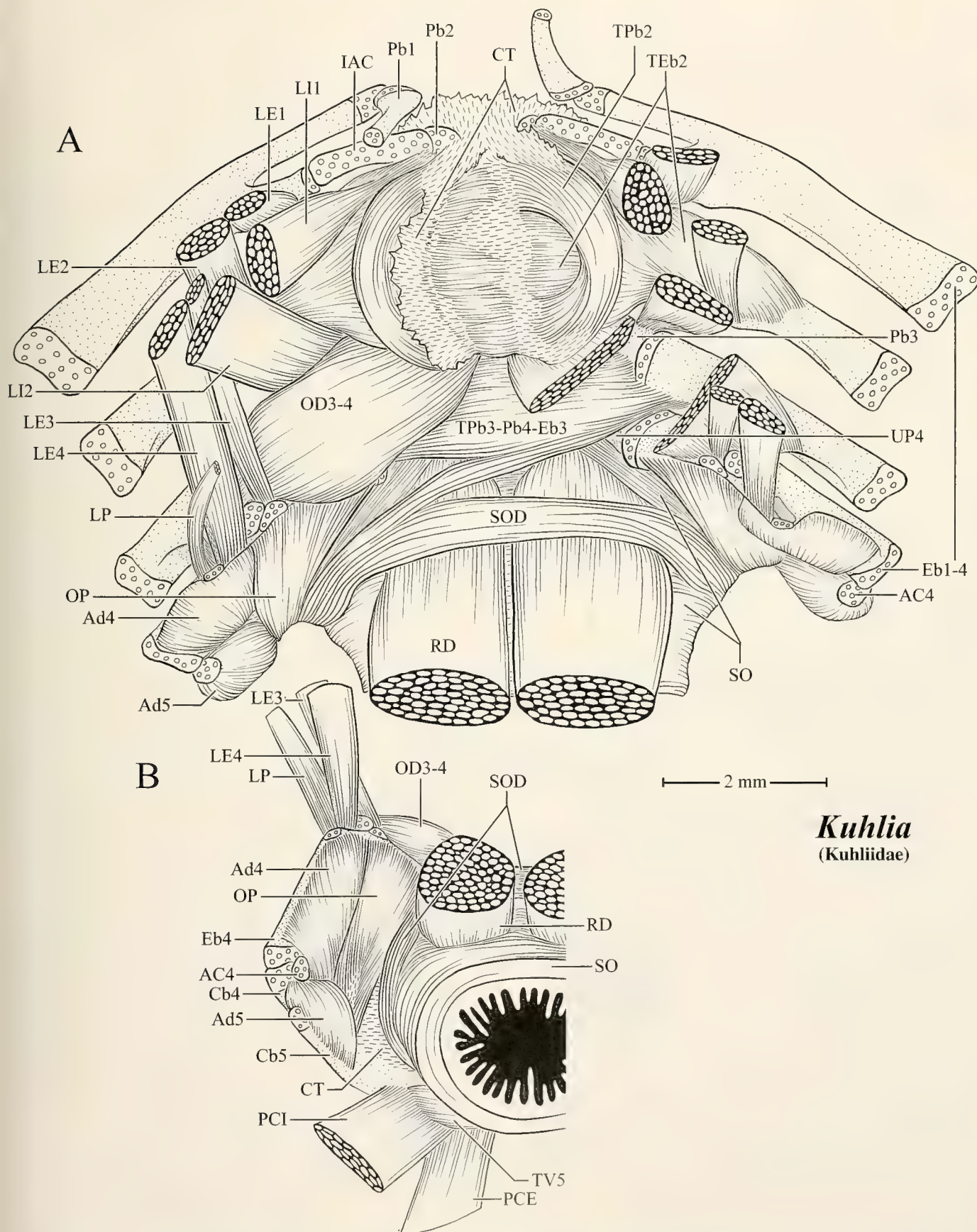
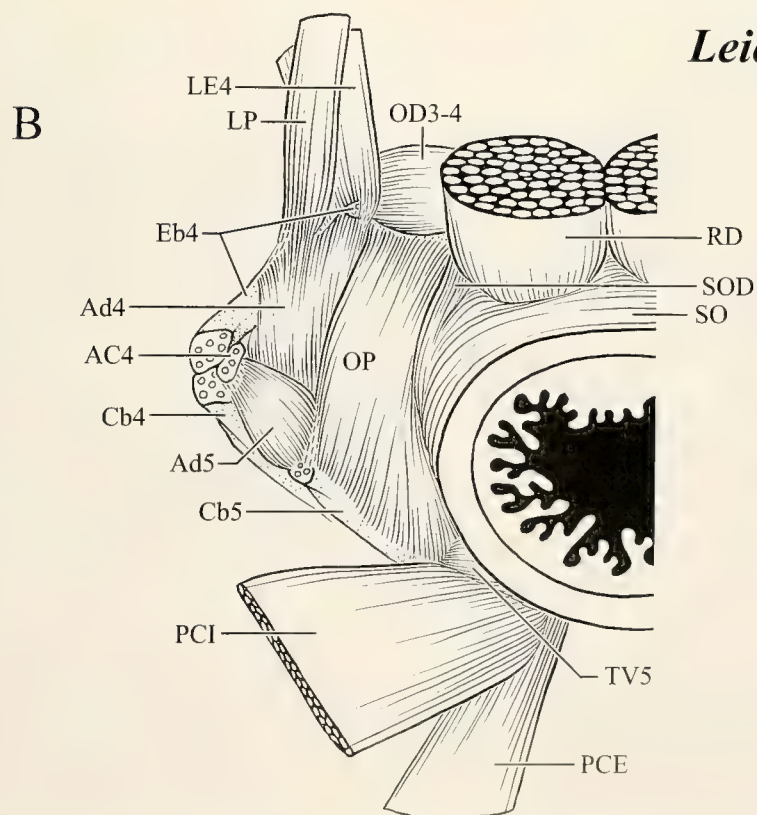
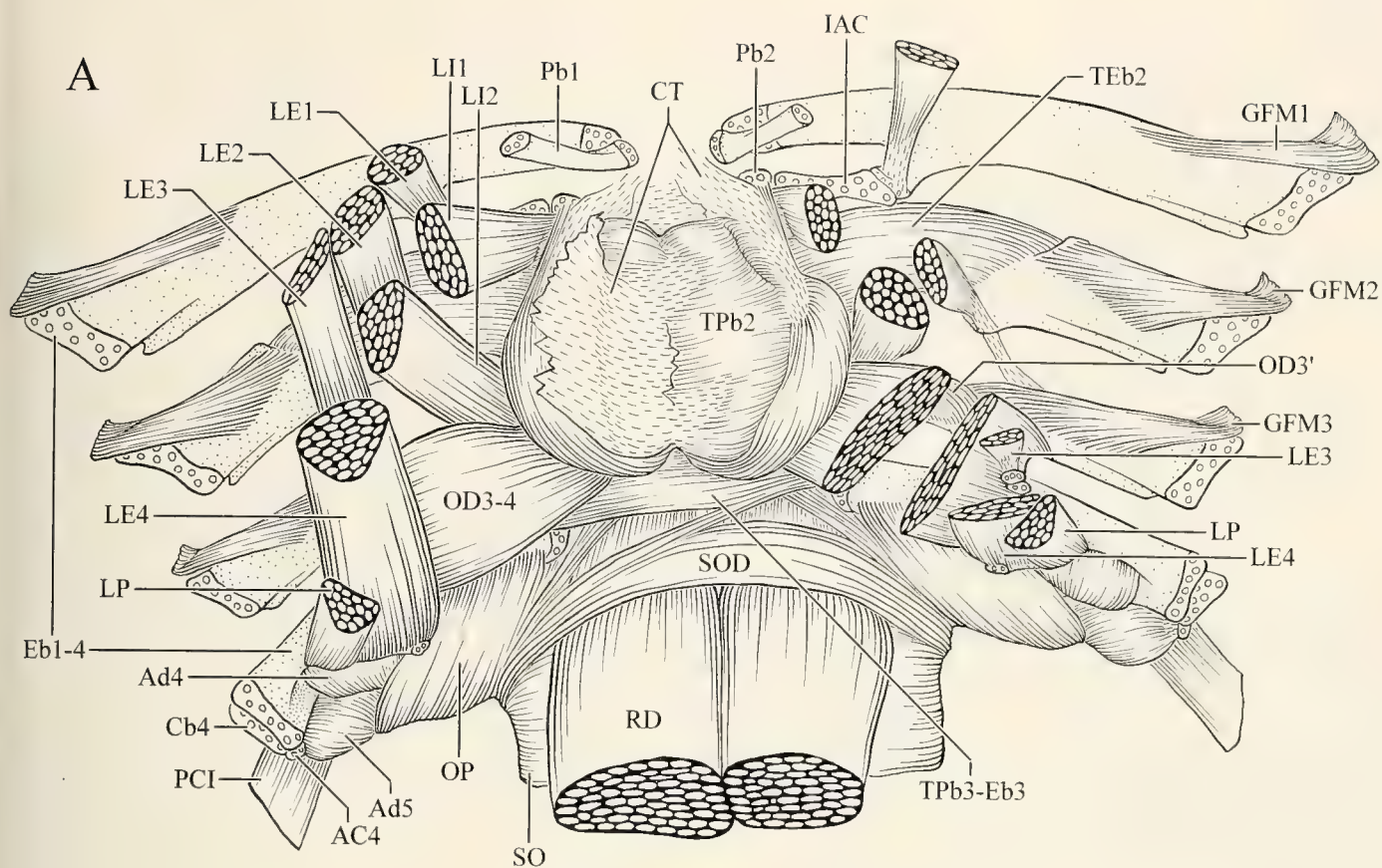


Plate 157. *Kuhlia mugil*, USNM 114998: A, dorsal view, most of CT covering TD removed; right-side Pb1 inclined anteriorly, OD3-4 bisected, LP removed (insertion position indicated by shading). B, posterior view, left side.





***Leiopotherapon***  
(Terapontidae)

Plate 158. *Leiopotherapon unicolor*, USNM173654: A, dorsal view, right-side CT attaching to TPb2 removed, OD3-4 bisected; fine CT joining LE4 over Eb4 levator process to Ad4 removed on both sides. B, posterior view, left side; fine CT tissue joining LE4 over Eb4 levator process to Ad4 partially removed.





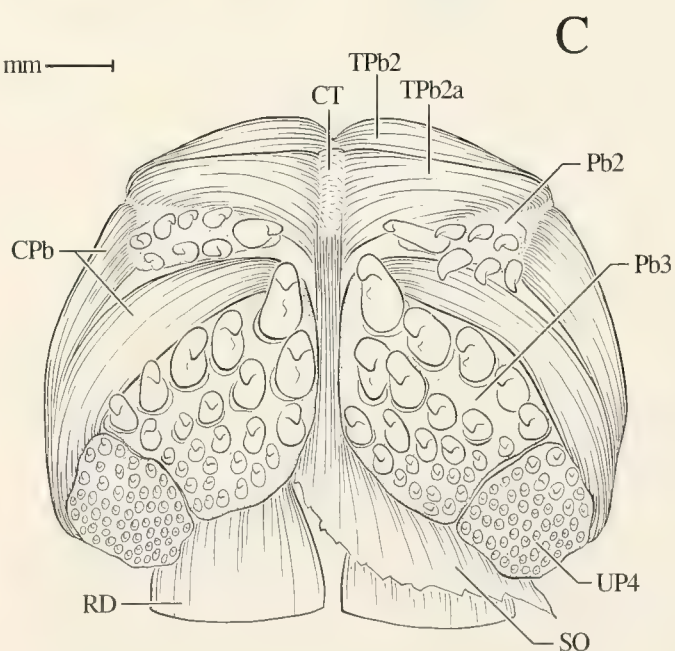
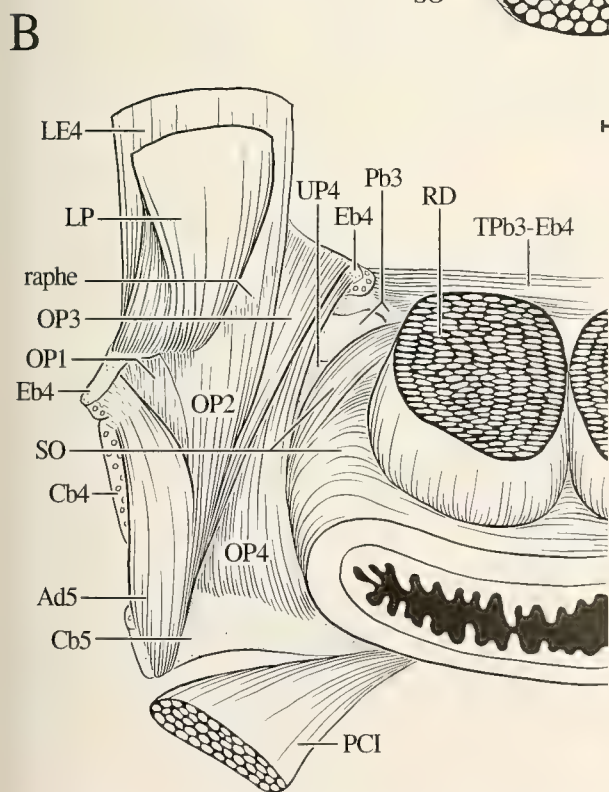
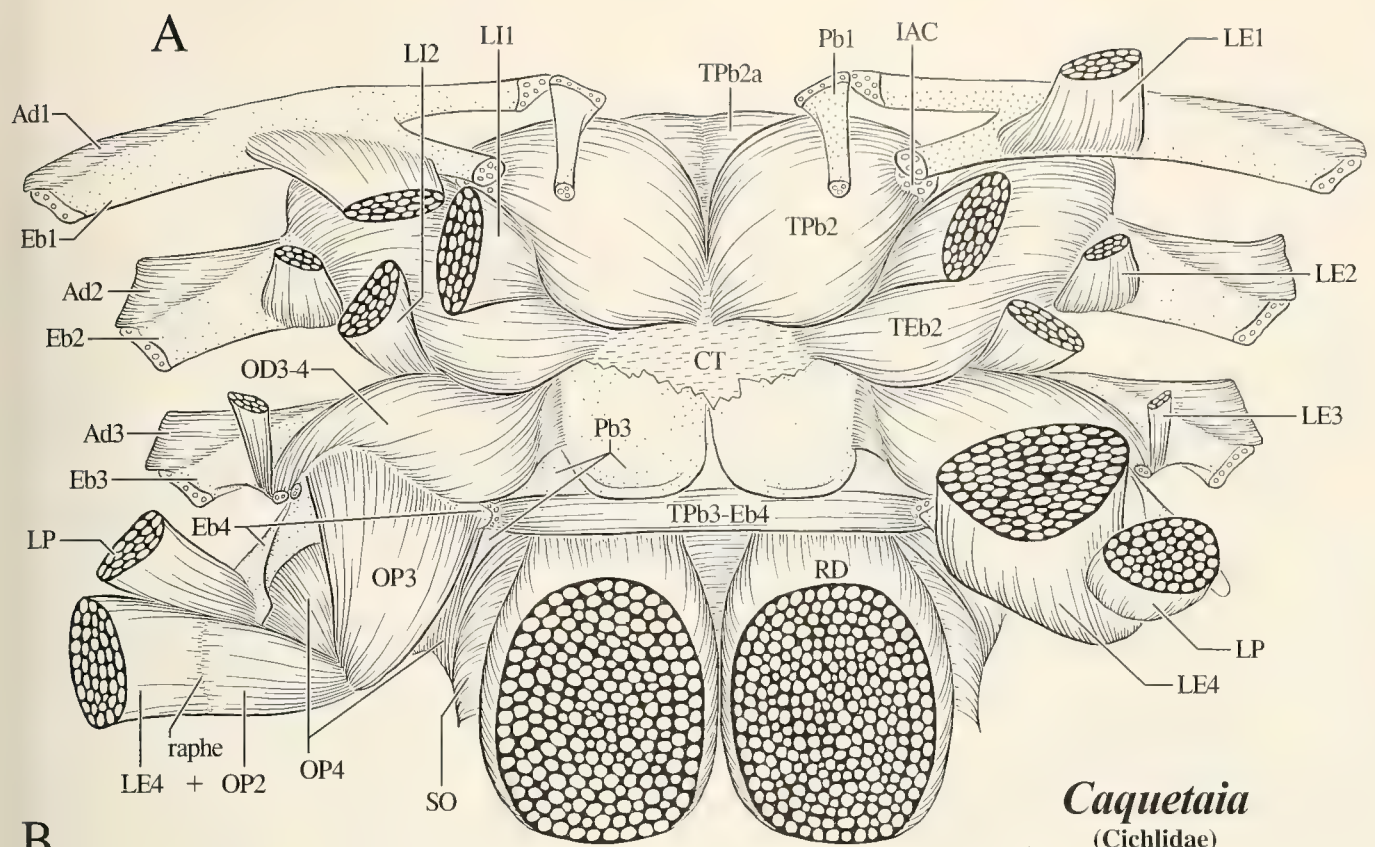


Plate 159. *Caquetaia kraussii*, USNM 258004: A, dorsal view, left-side LE4 and LP rotated clockwise to reveal underlying muscles (strip of LE4 attaching to Eb4 lateral to Od4 torn by rotation); CT sheet overlying Pb3 facets cut away to show attachment of OD4. B, posterior view, left side; Ad4 not visible. C, ventral view of pharyngobranchials and associated muscles (roof CT removed to reveal CPb).



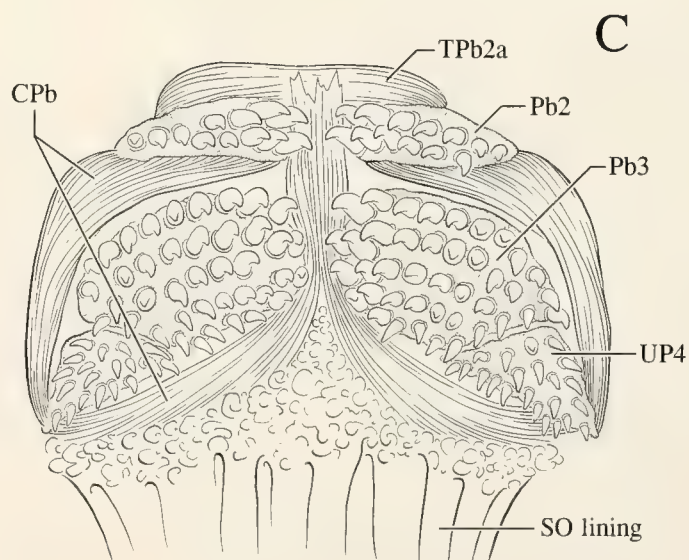
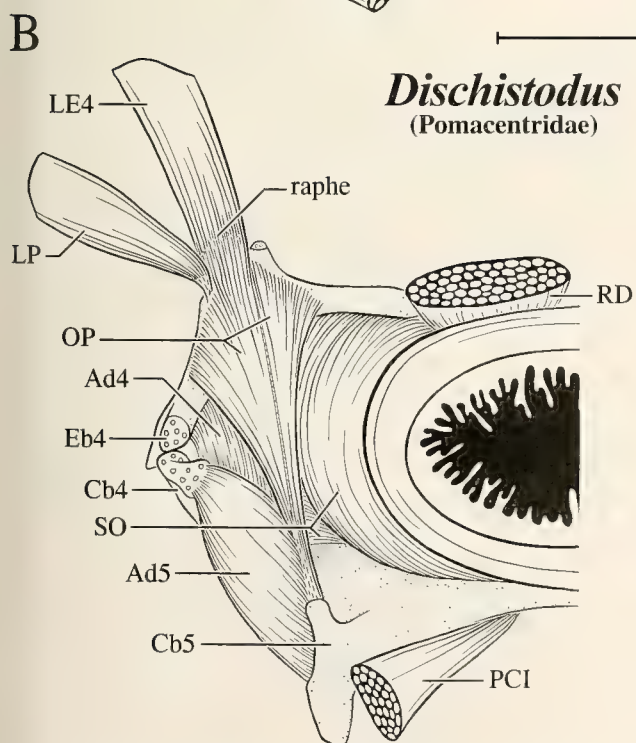
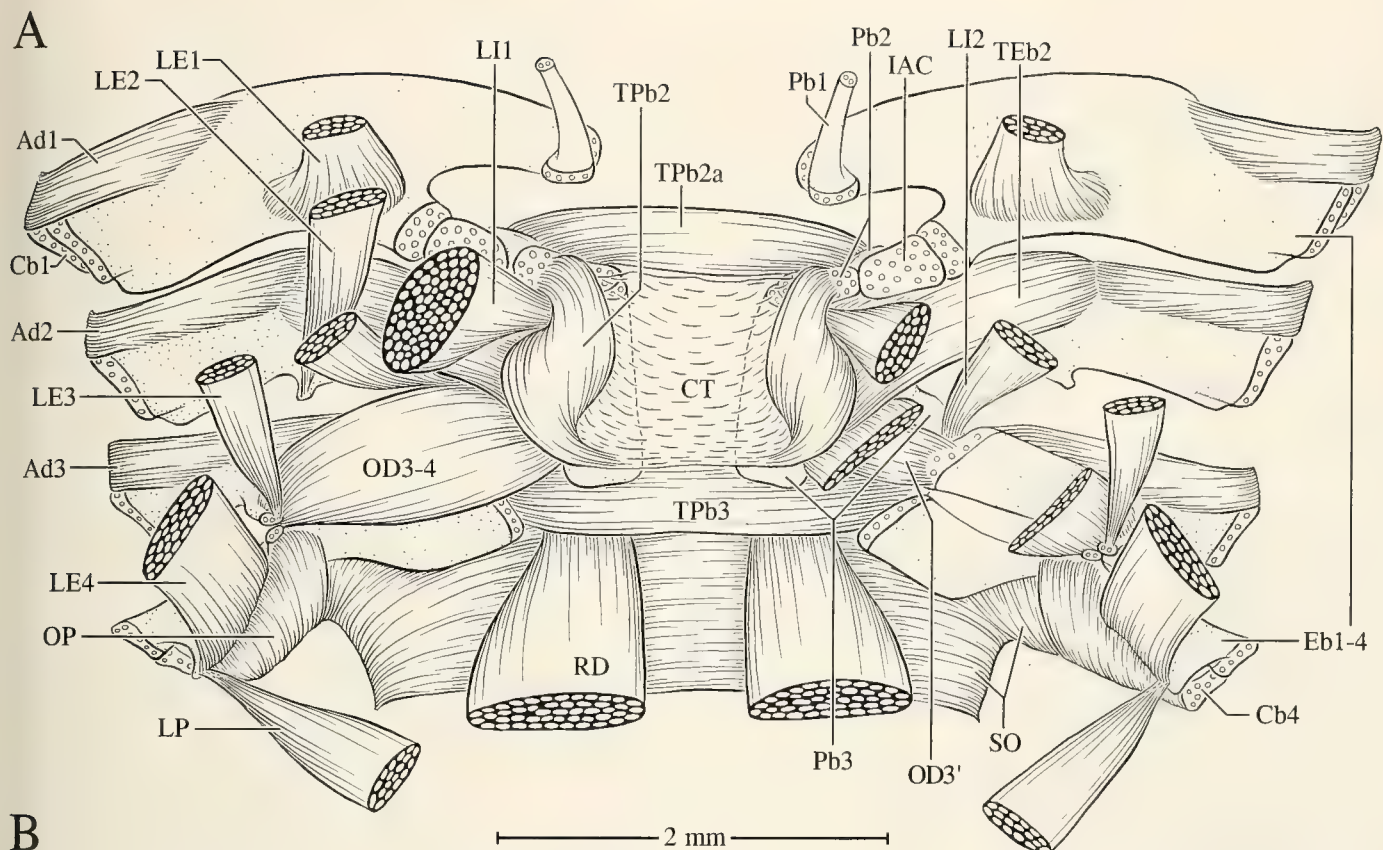
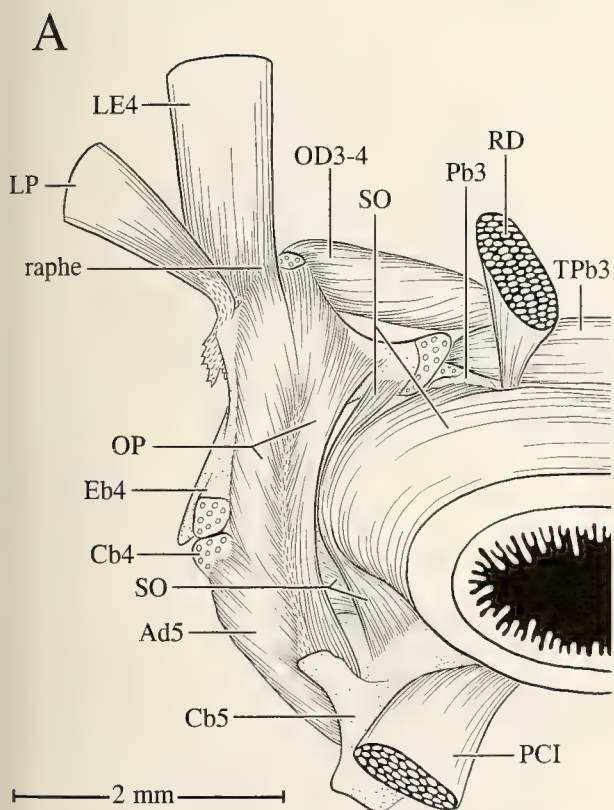


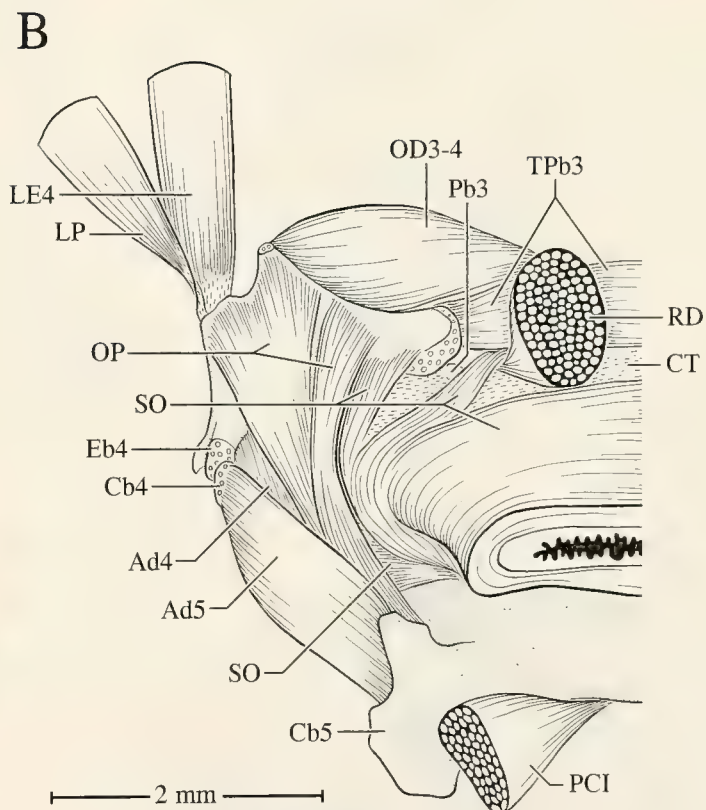
Plate 160. *Dischistodus fasciatus*, USNM 328190: A, dorsal view, medial margins of Pb3s indicated by dashed lines, right-side OD3-4 cut away. B, posterior view, left side. C, ventral view of pharyngobranchial area, pharyngeal roof tissue removed to show CPb.





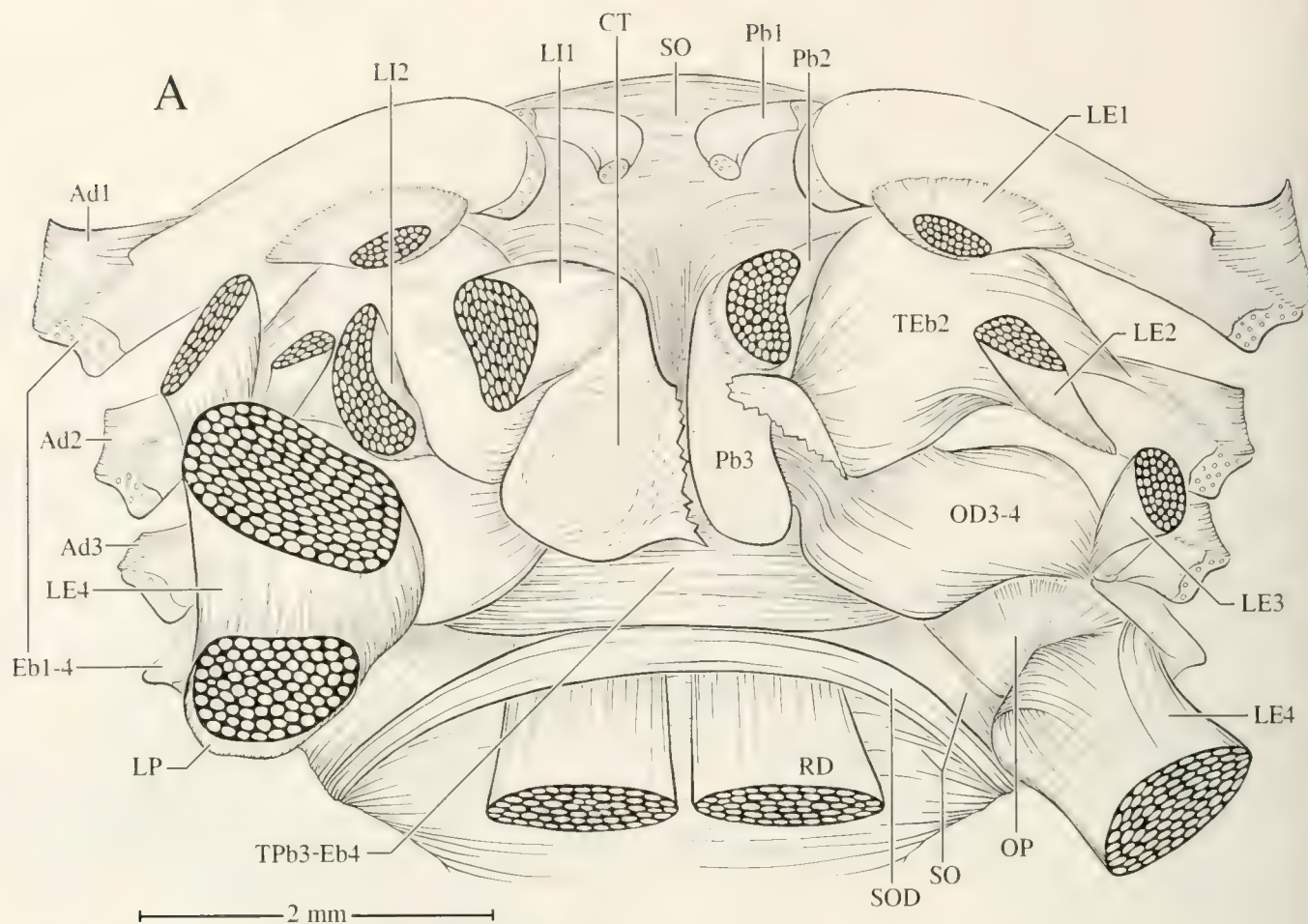


***Abudefduf***  
(Pomacentridae)

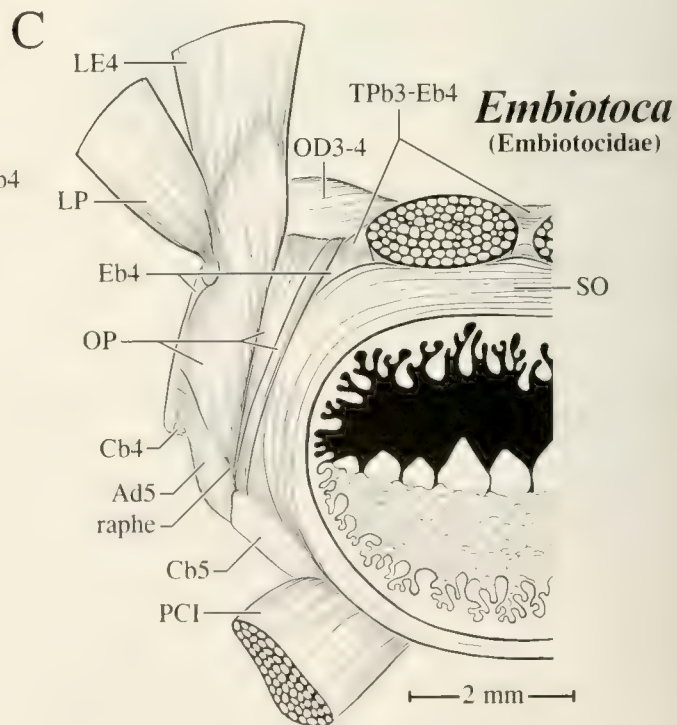
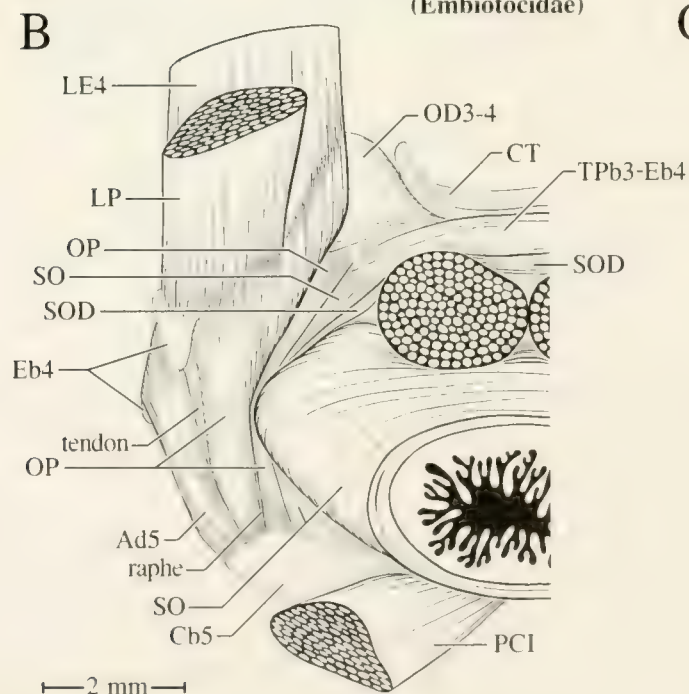


***Chromis***  
(Pomacentridae)

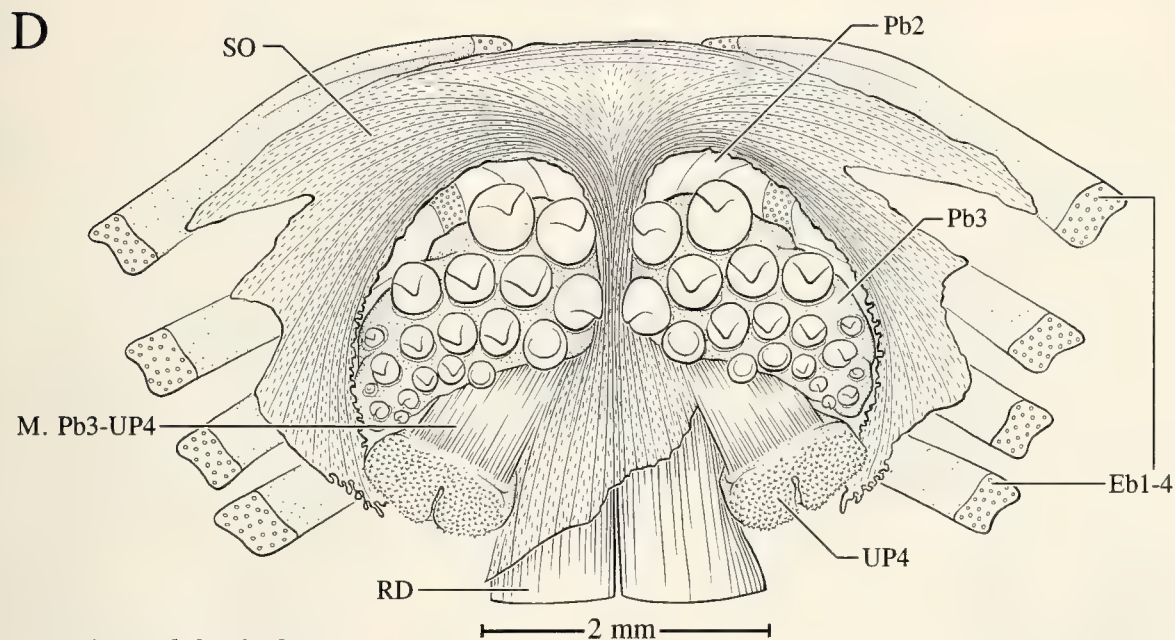
Plate 161. A, *Abudefduf sexfasciatus*, USNM 221863: posterior view, left side. B, *Chromis amboinensis*, USNM 338153: posterior view, right-side reversed.



*Amphistichus*  
(Embiotocidae)



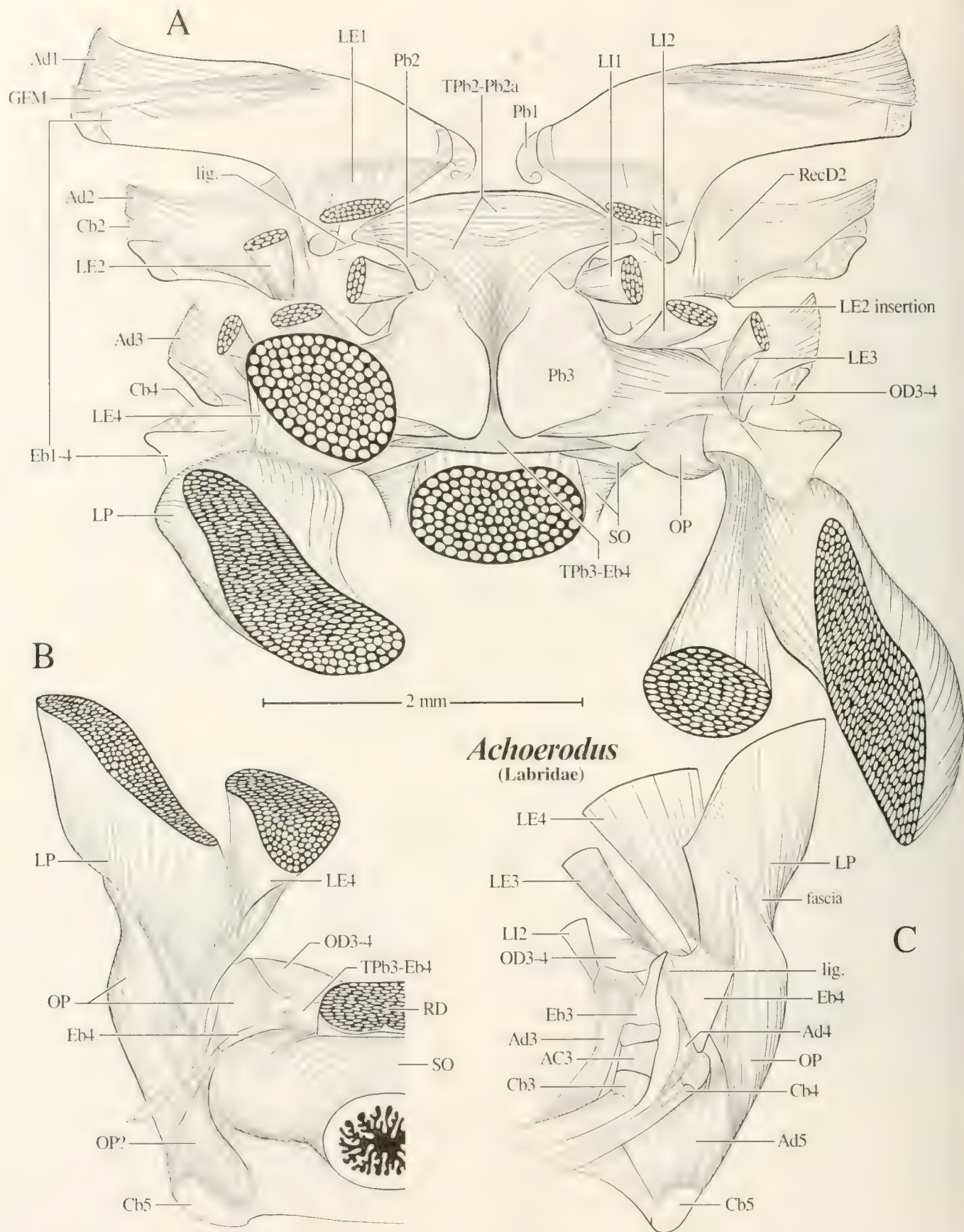
*Embiotoca*  
(Embiotocidae)



## *Amphistichus*

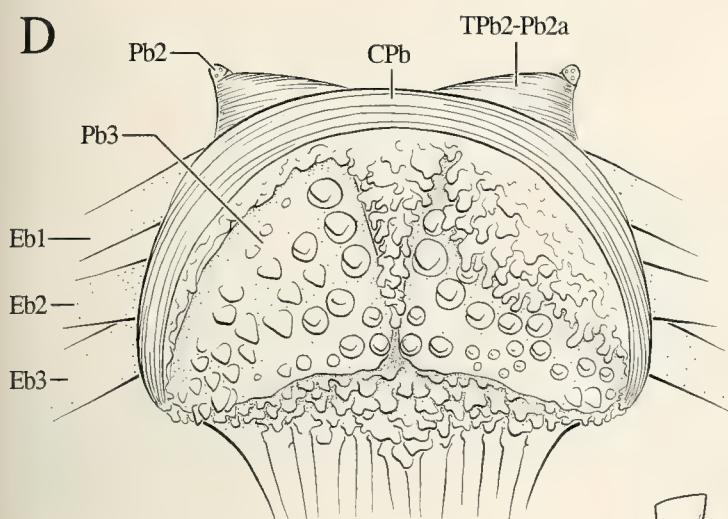
Plates 162.1, 162.2. A, B, and D, *Amphistichus argenteus*, USNM 132403: A, dorsal view, right-side LI2 removed, CT cut away to reveal Pb3 articulating facet, and LE4 pulled posteriorly (obscuring LP) to reveal OP, OD3' not visible. B, posterior view, left side. D, pharyngeal area, ventral view, SO fibers permeate pharyngeal-roof CT (much abbreviated laterally and posteriorly and removed from between Pb3 and UP4 to reveal M. Pb3-UP4 and RDs). C, *Embiotoca lateralis*, USNM 340889: posterior view, right side reversed, LP rotated clockwise.





Plates 163.1, 163.2. *Achoerodus viridis*, USNM 218488: A, dorsal view, right-side LE4 and LP rotated posteriorly and counterclockwise and LE2 removed. B, posterior view, right side reversed, LE4-LP complex rotated posteriorly, fascia not indicated (see C). C, lateral view, gill arches 3-5, right side reversed. D, ventral view to show CPh, left-side tissues bordering Pb3s mostly removed. E, anterior view.

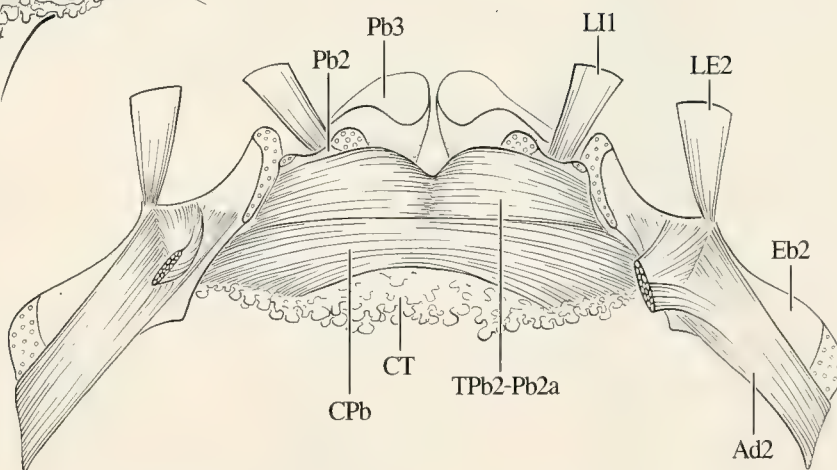
D

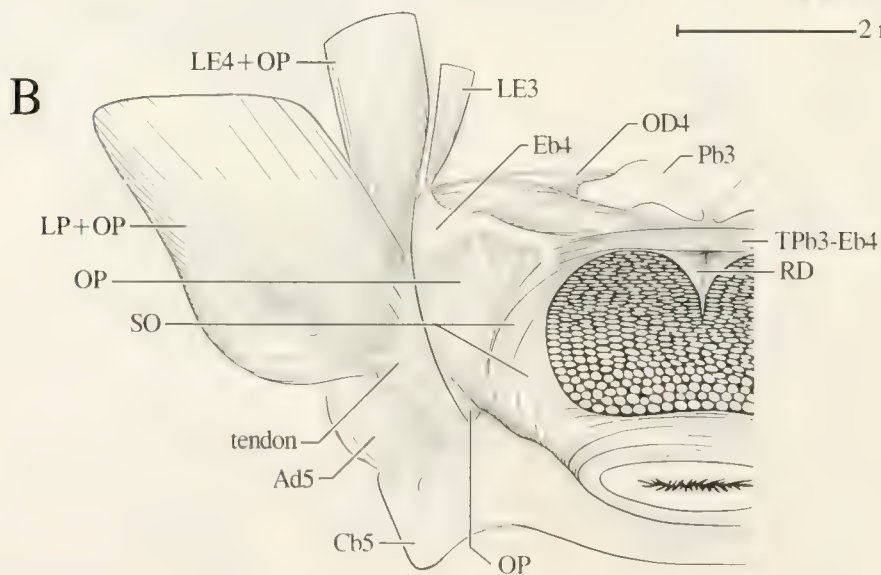
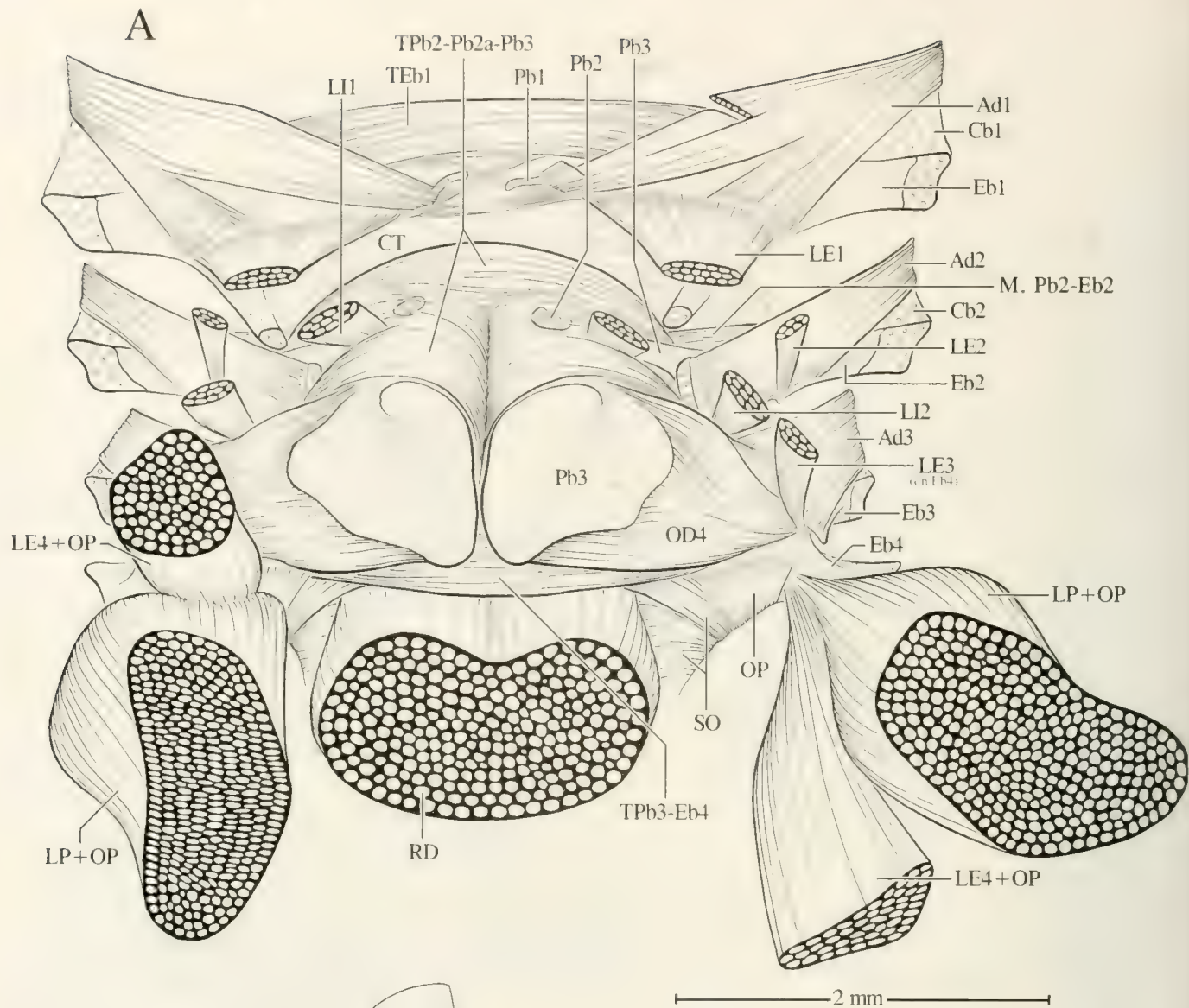


2 mm

*Achoerodus*

E



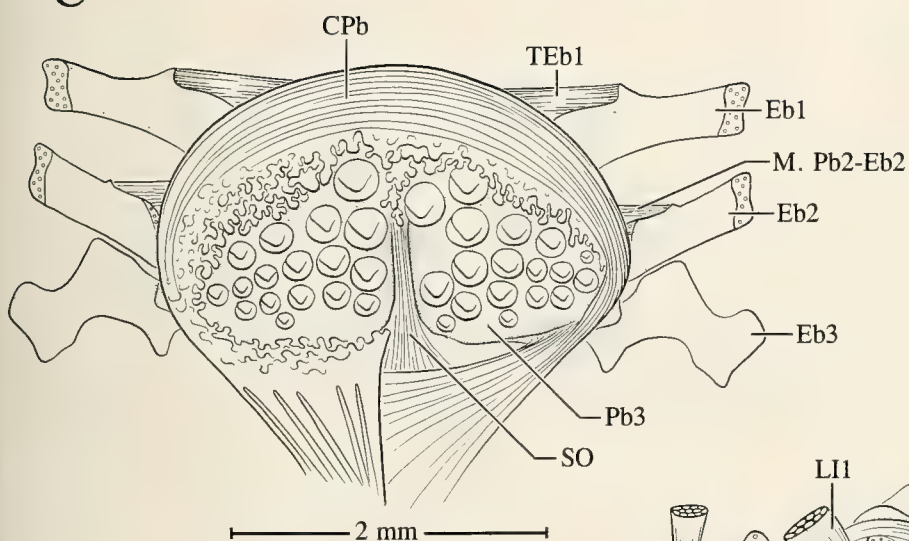


***Symphodus***  
(Labridae)

Plates 164.1, 164.2. *Symphodus roissali*, USNM 198879: A, dorsal view, anterior portion of right-side Ad1 cut away to reveal attachment of TEb1 (dotted line indicates anterior edge of Eb1), dorsal cartilaginous tips of Pb2 covered slightly by thin layer of muscle fibers, right-side LE4 and LP rotated counterclockwise. B, left side, posterior view. C, ventral view, Eb4s and right-side esophageal surface removed. D, anterior view: first gill arch removed; dotted lines on right side indicate extent of Pb2 covered by muscle.

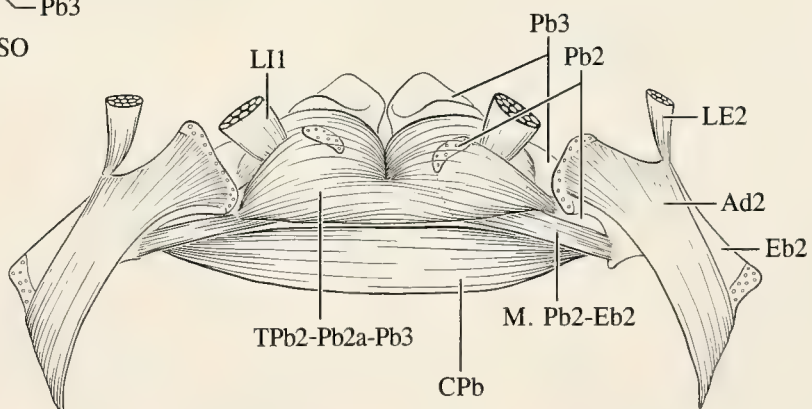


C



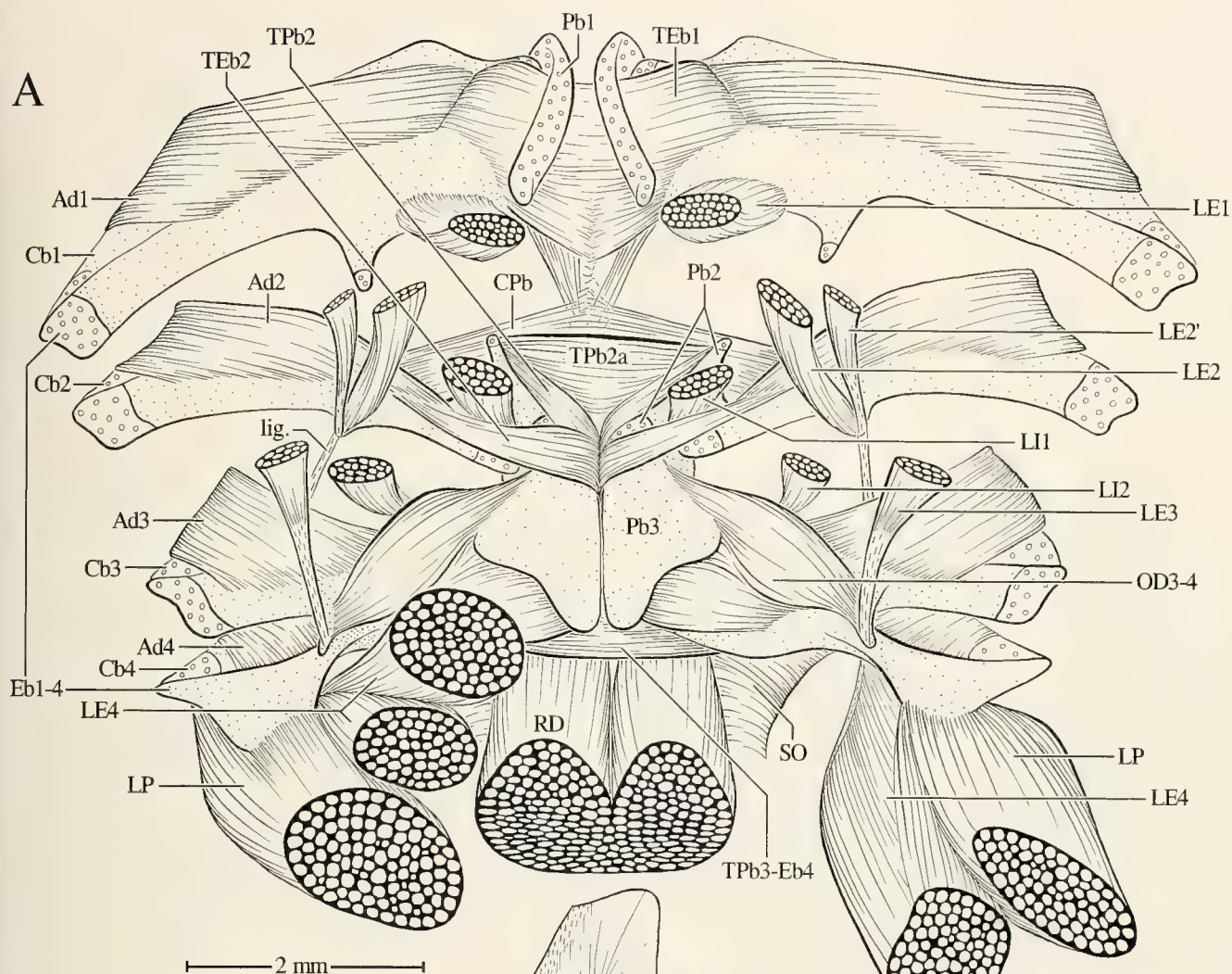
*Symphodus*

D









***Polylepion***  
(Labridae)

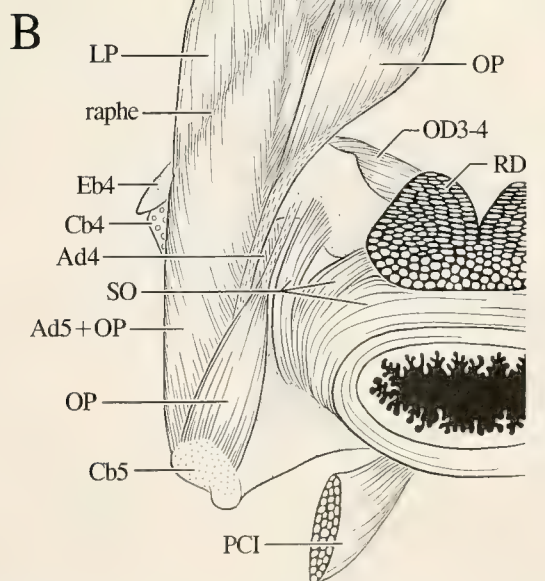


Plate 165. *Polylepion cruentum*, USNM 215466: A, dorsal view: right-side LE4-LP-OP complex rotated counter-clockwise. B, posterior view, left side. See discussion of LE2' in section Labroidae.



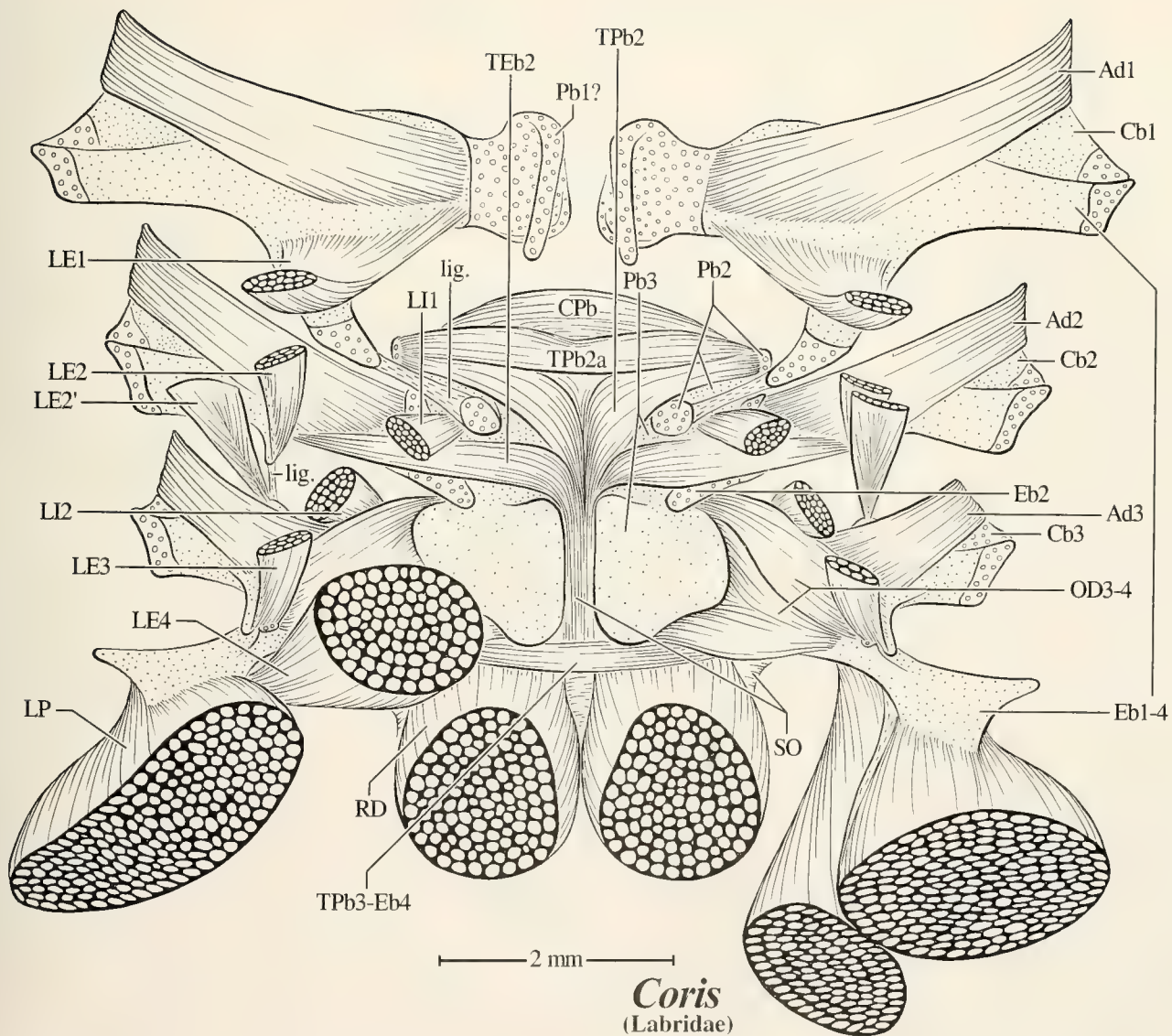


Plate 166. *Coris julis*, USNM 337450: dorsal view, right-side LP-LE4 complex rotated counter-clockwise, Pb3 dorsal articulating facets separated to expose SO. See discussion of LE2' in section Labroidea.

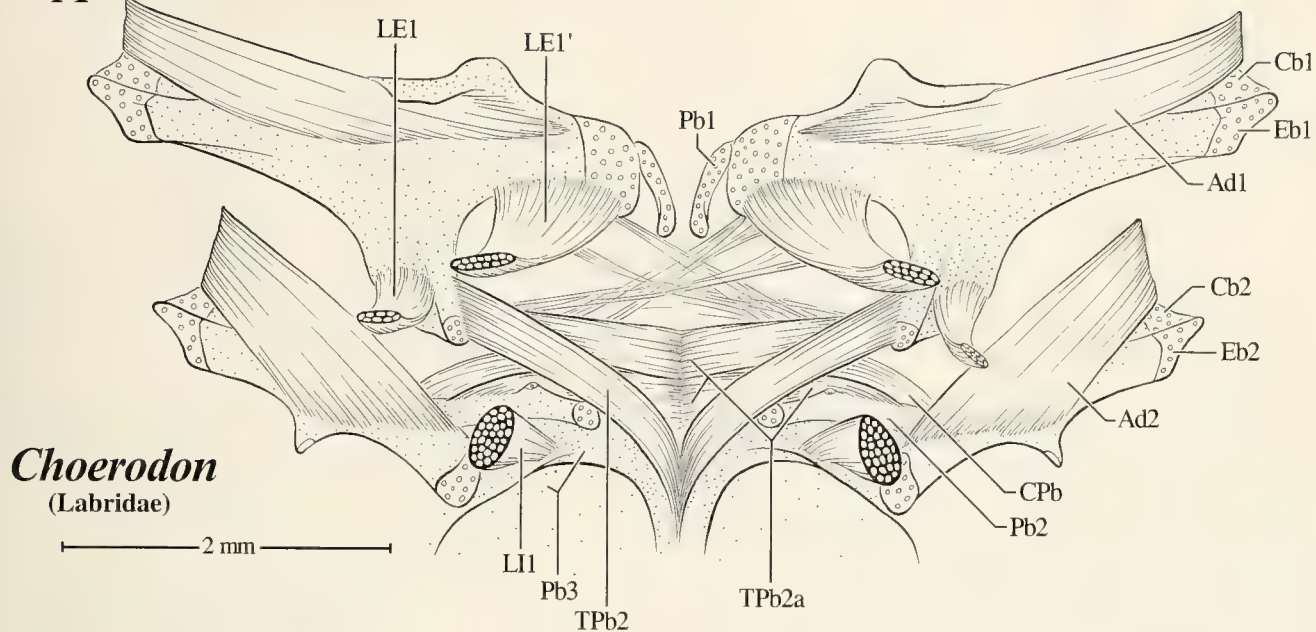


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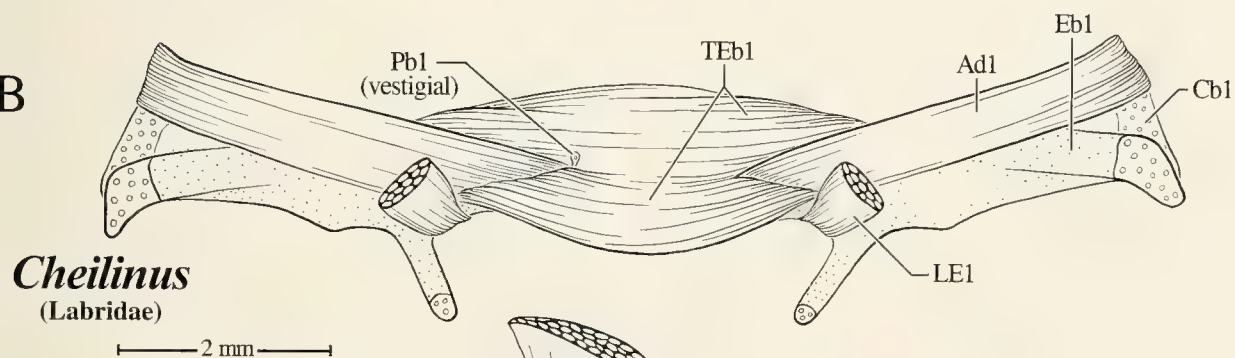
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Plate 167. A, *Choerodon graphicus*, USNM 218548: dorsal view of anterior portion of gill arches, LE2s removed. Note: TEb1 lies posterior to Pb1s and attaches to Eb1 on medial edge of distal end of uncinatate processes (compare with B); TPb2 fibers are directly adjacent and posterior to TEb2; muscle strands extending from medial ends of Eb1s join CPb (not shown), which lies ventral to TEb2-TPb2a complex. B, *Cheilinus trilobatus*, USNM 224020: dorsal view of arch 1 (anterior toward top of page), for comparison with A. C, *Clepticus parrae*, USNM 318548, posterior view, left side for comparison with other labrids).

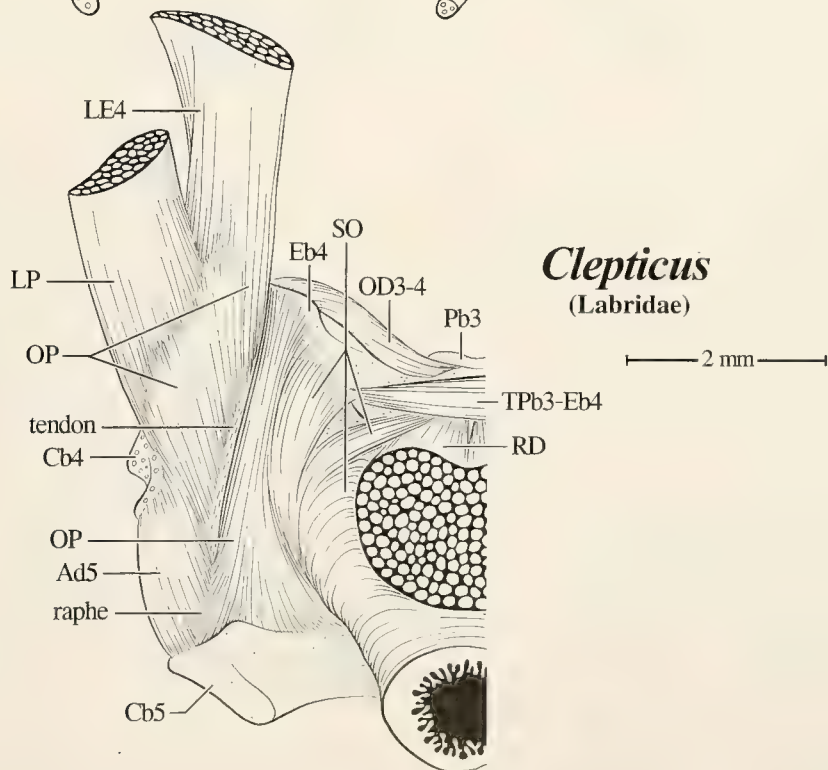
A



B



C





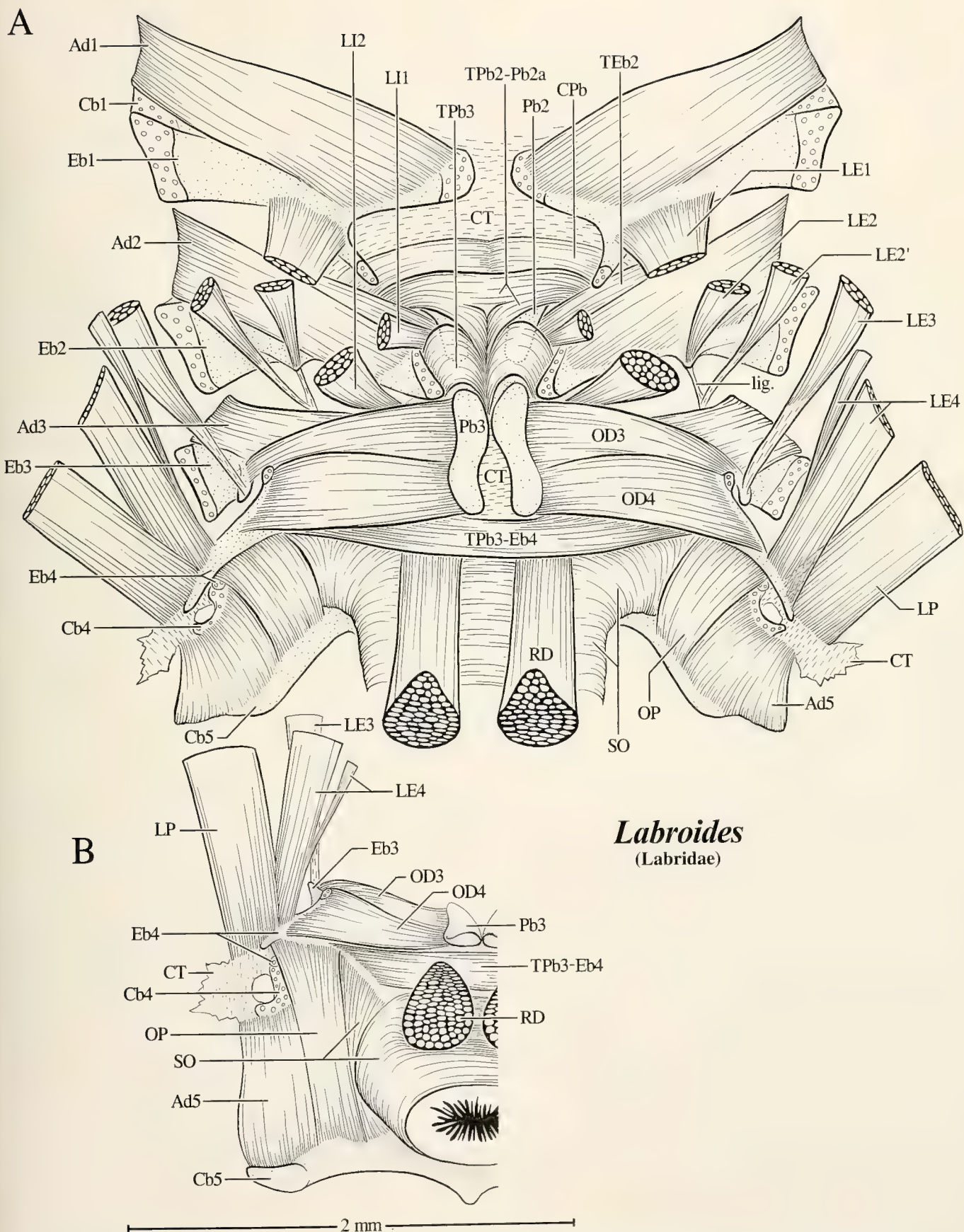


Plate 168. *Labroides dimidiatus*, USNM 309376: A, dorsal view. B, posterior view, right side reversed. See discussion of LE2' in section Labroidea.









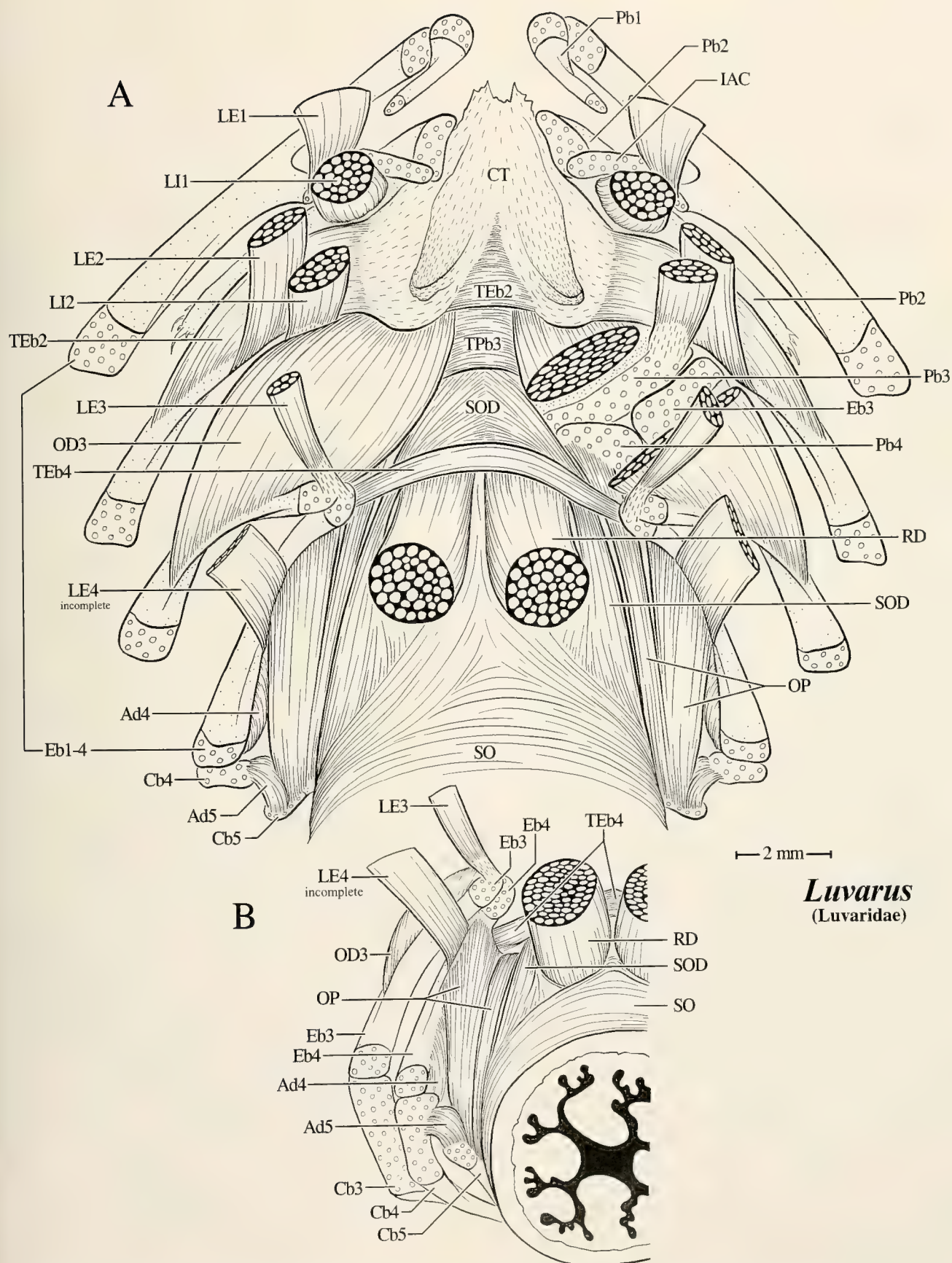
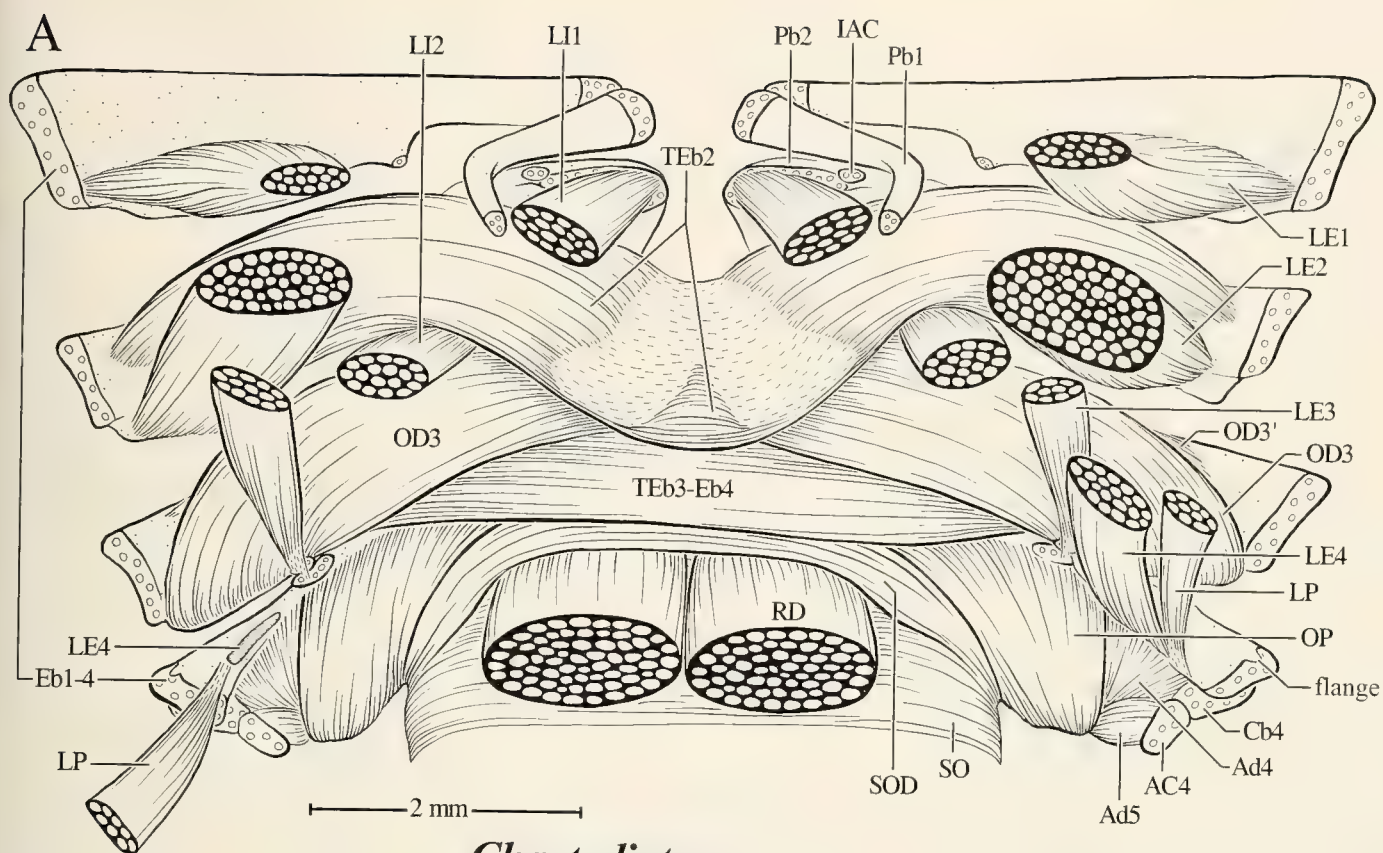


Plate 170. *Luvarus imperialis*, MCZ 55003, LE4s incomplete and LP (not illustrated) lost during dissection; see remarks following LE4 in species account: A, dorsal view, right-side OD3 cut away; LE1s rotated anteriorly. B, posterior view, left side.







*Chaetodipterus*  
(Ephippidae)

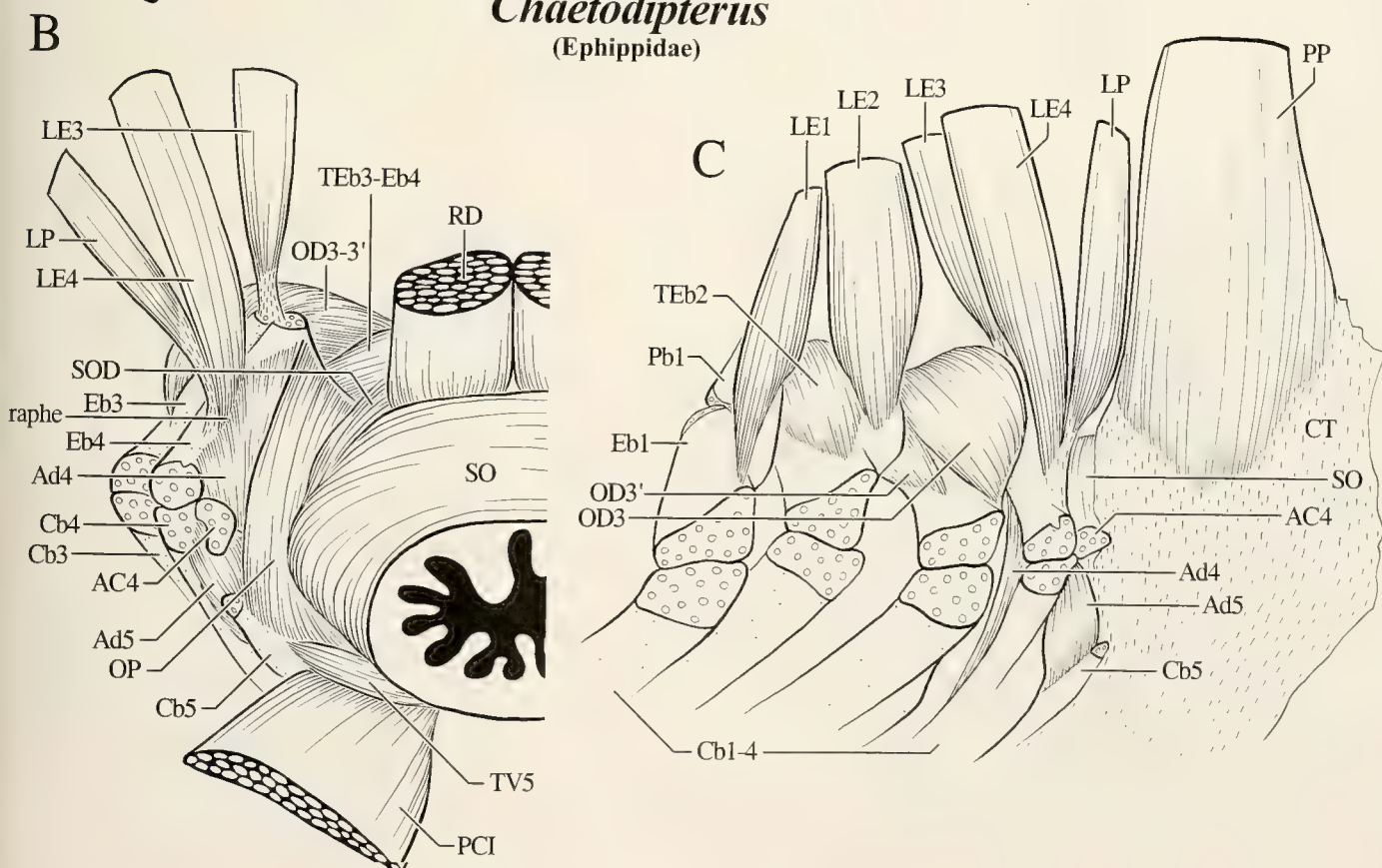
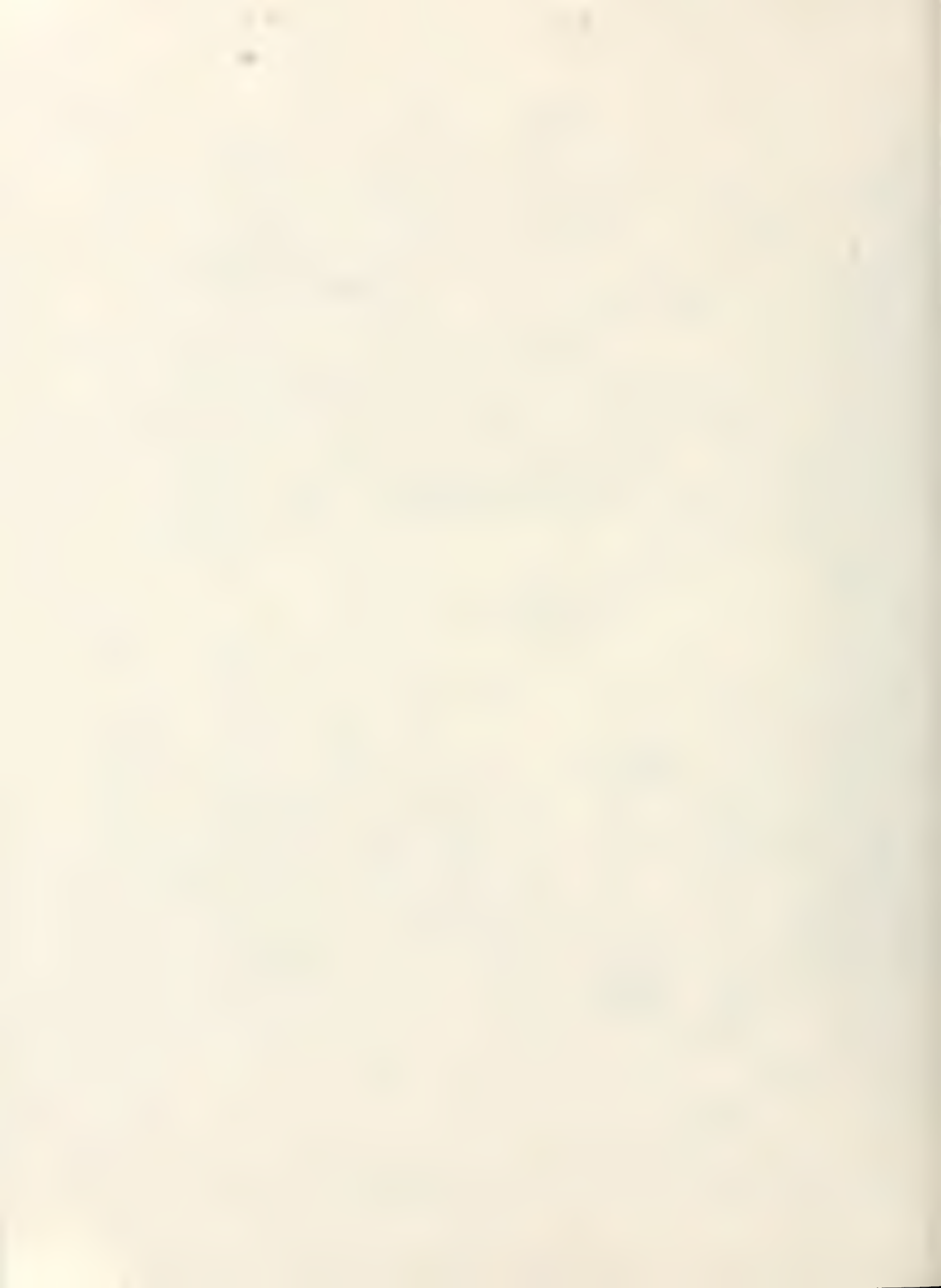


Plate 171. *Chaetodipterus faber*, USNM 289421: A, dorsal view, left-side LE4 removed (insertion position indicated by shading), LP forced posteriorly. B, posterior view, left side. C, lateral view, right-side reversed, PP included.



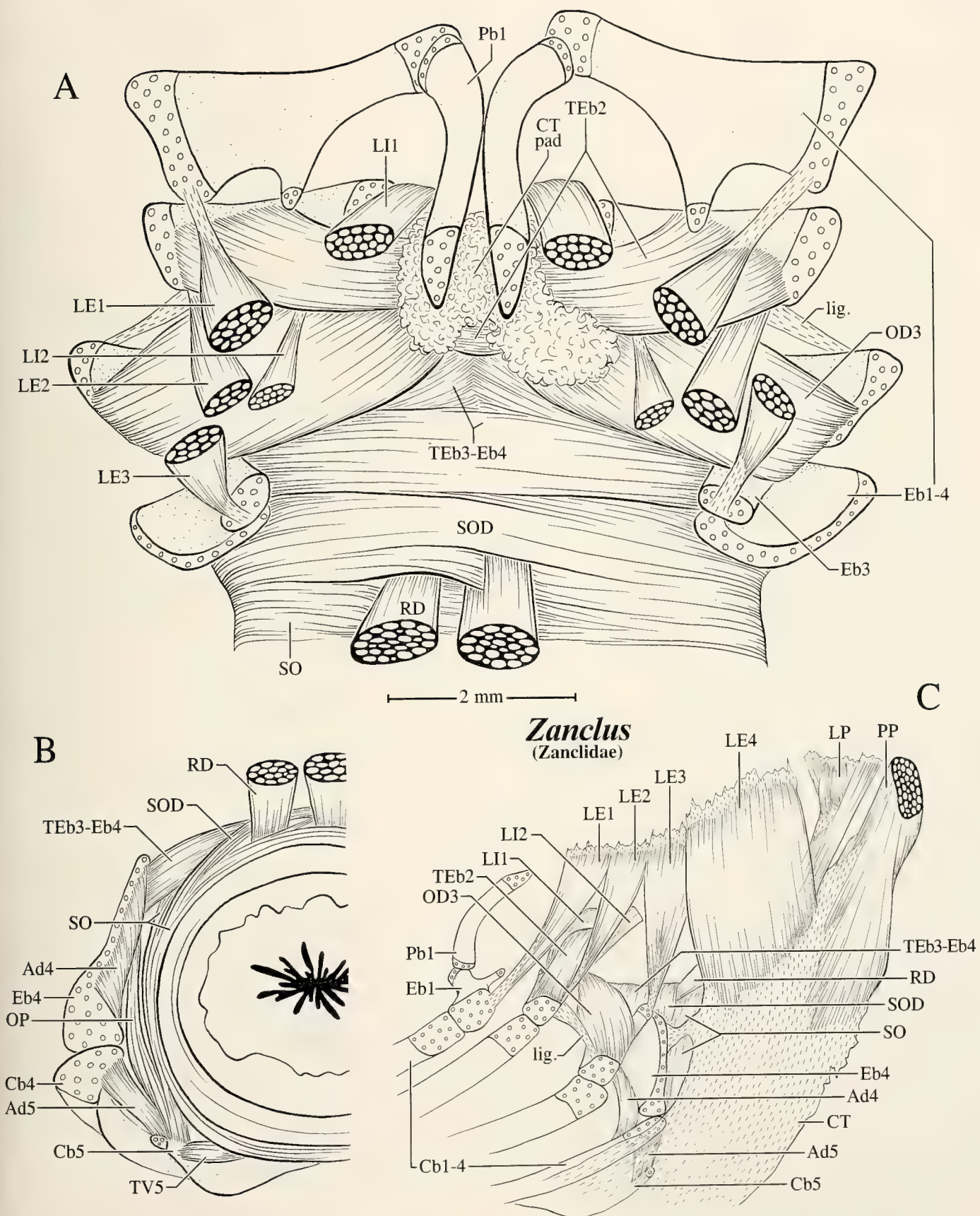
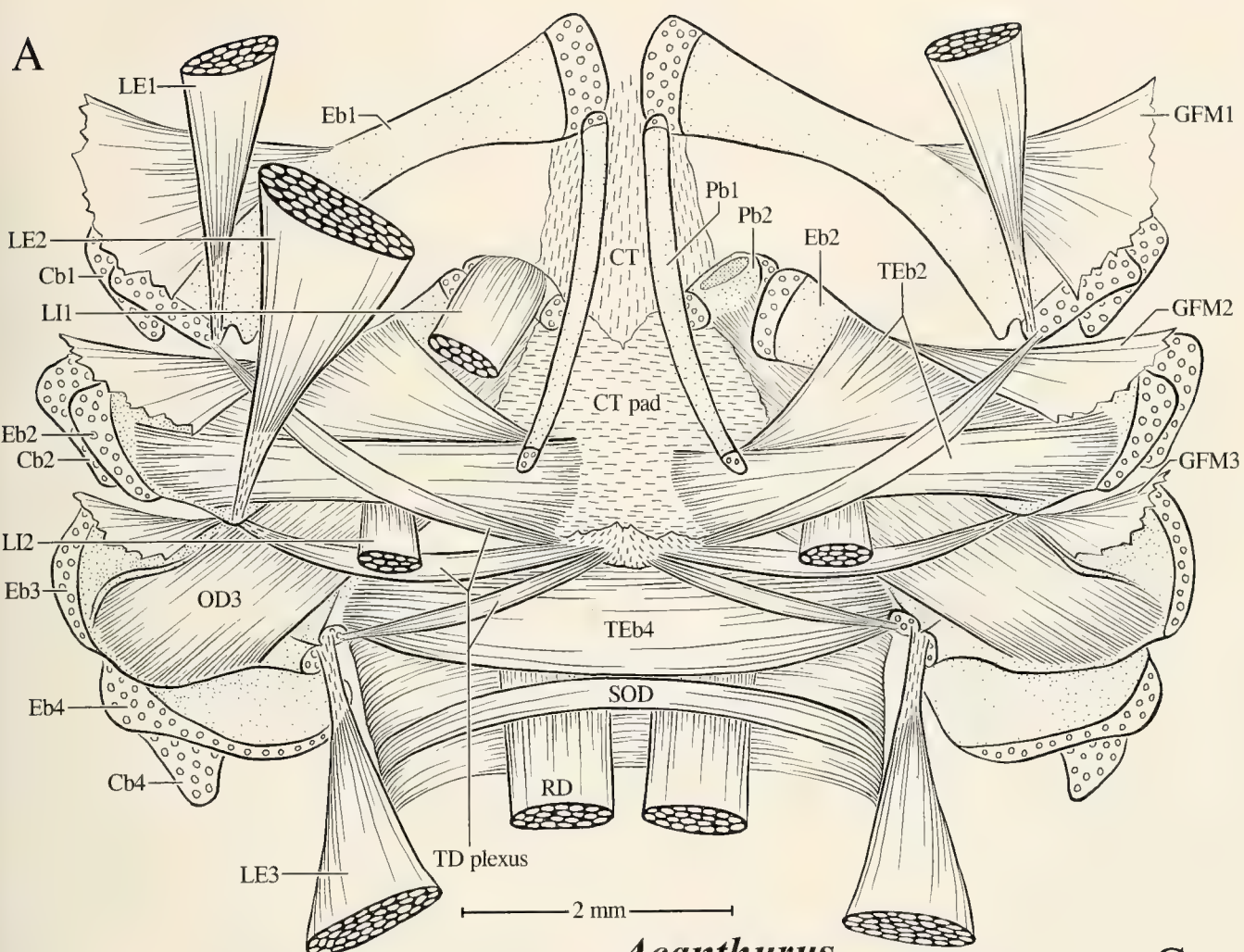


Plate 172. *Zanclus cornutus*, USNM 350564: A, dorsal view; LE4-LP-PP muscle sheet removed, levators severely truncated. B, posterior view, right side reversed, LE4-LP-PP muscle sheet removed. C, lateral view.







*Acanthurus*  
(Acanthuridae)

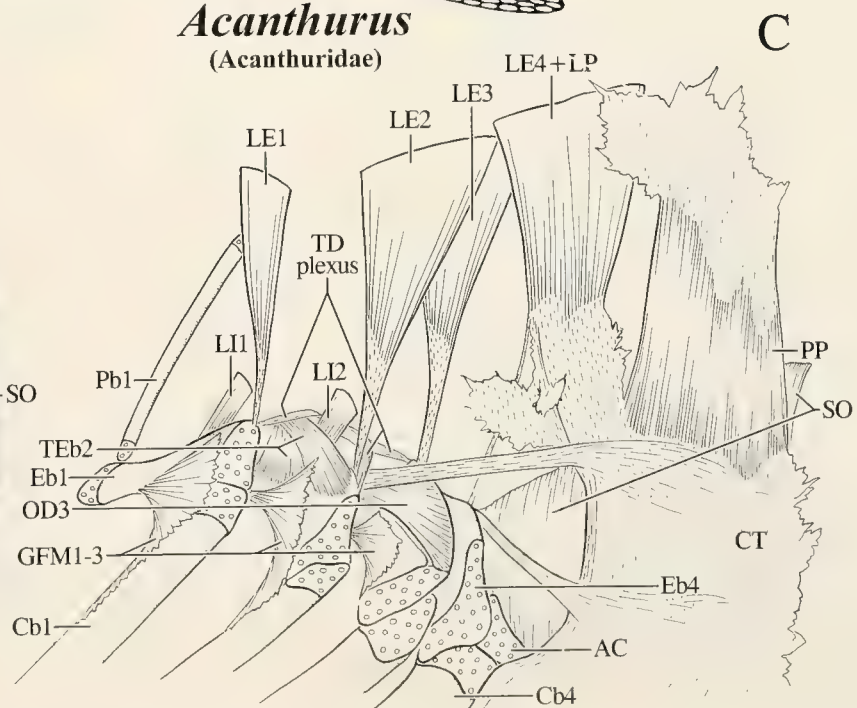
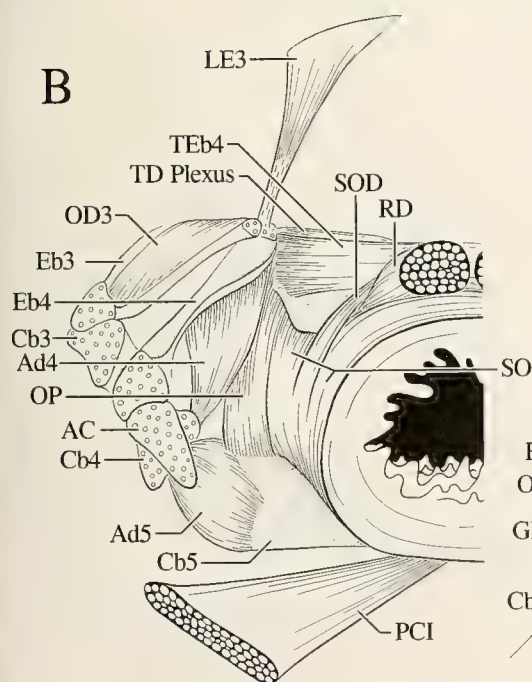
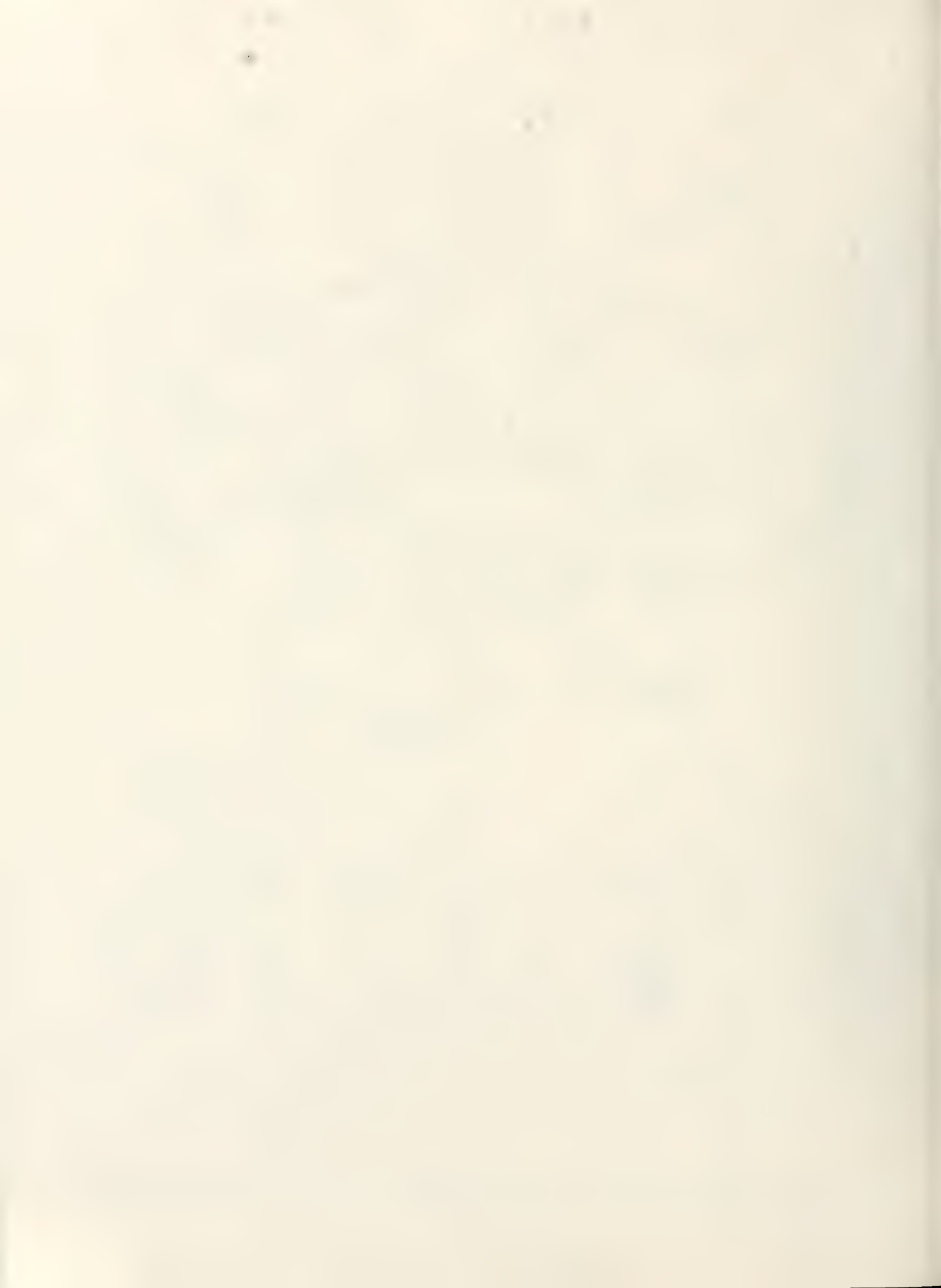
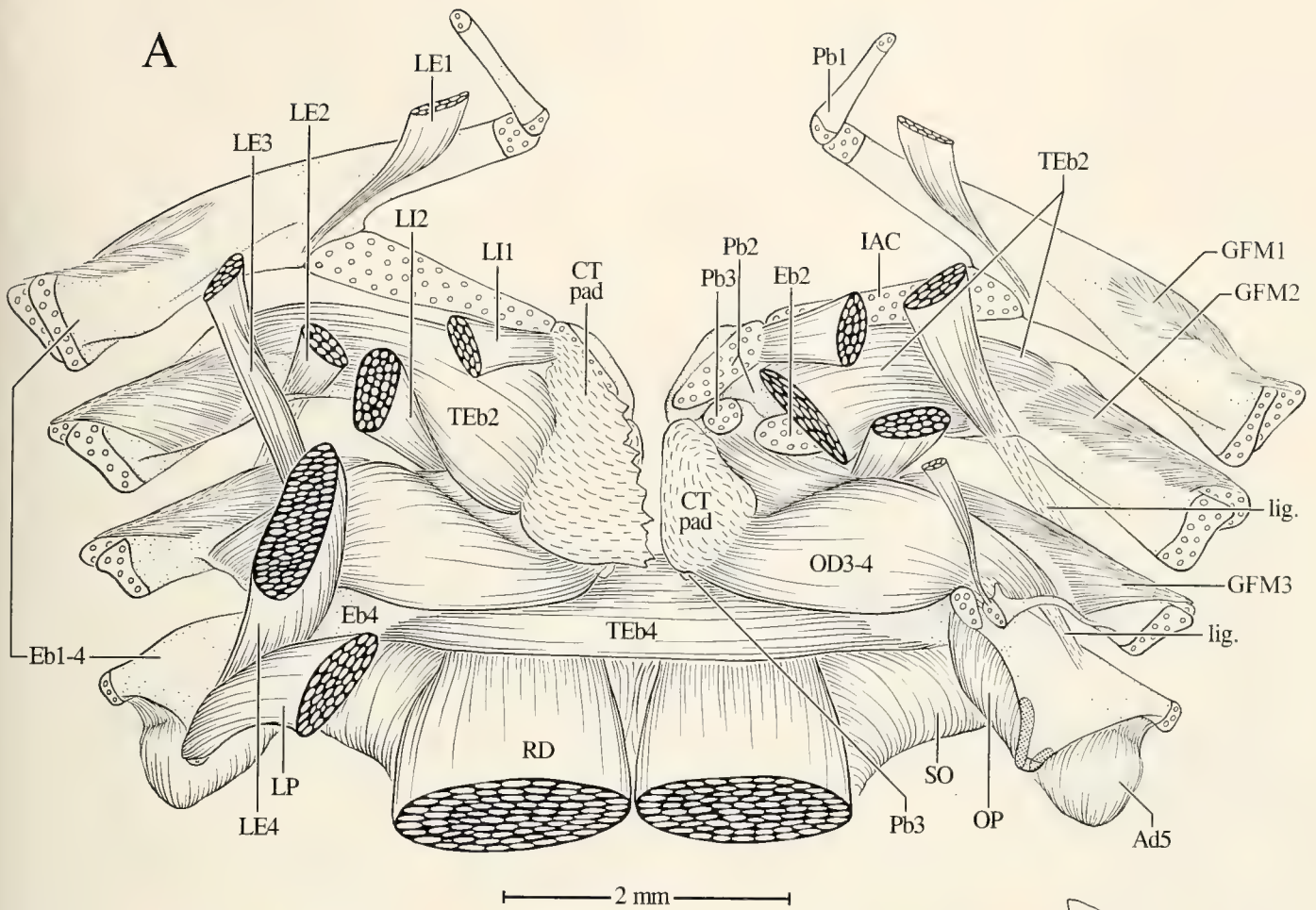


Plate 173. *Acanthurus nigrofusus*, USNM 338195: A, dorsal view (perspective deliberately distorted), right-side LE2 and LI1 removed (insertion position of LI1 indicated by shading), other levators greatly truncated; LE4+LP+PP and associated CT removed from both sides, continuity of TEb4 and SOD not shown. B, posterior view, right side reversed, LE4+LP+PP removed. C, lateral view, left side, LI1 and LI2 greatly truncated.



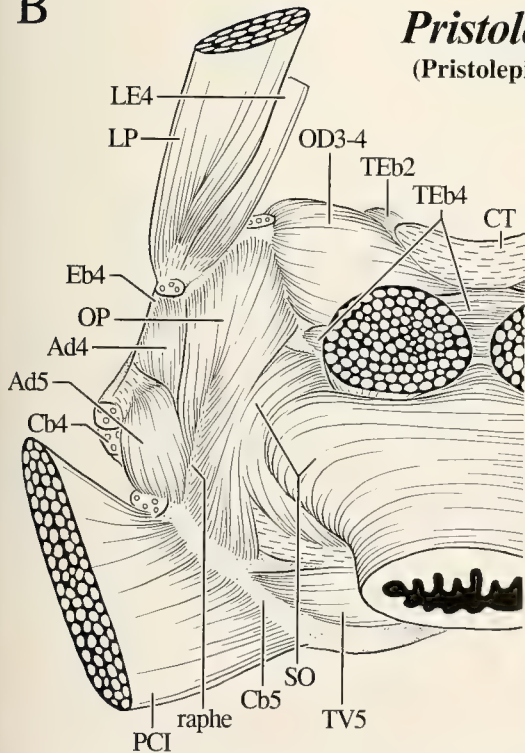


A



B

*Pristolepis*  
(Pristolepidae)



C

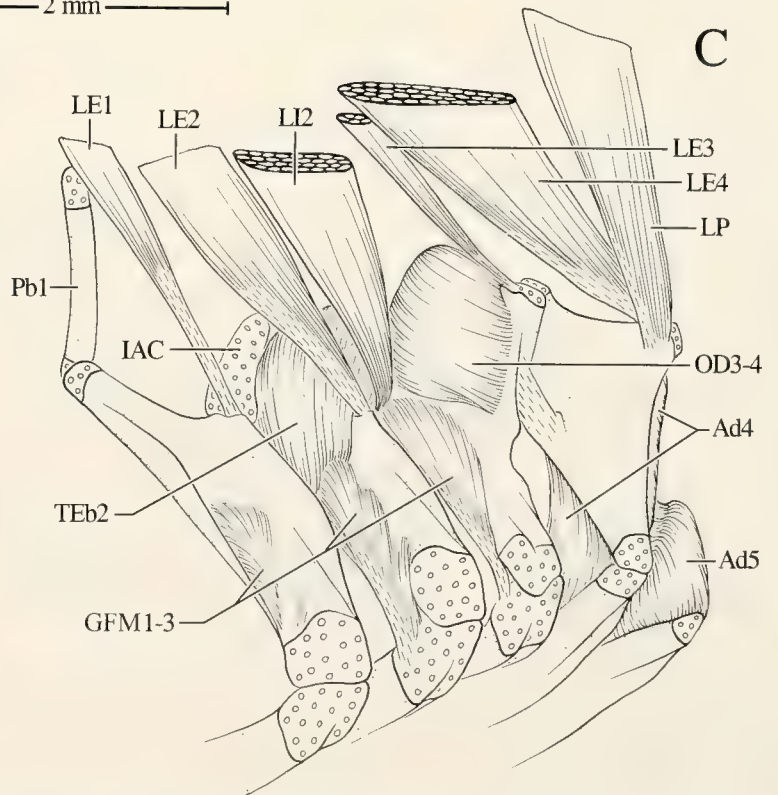
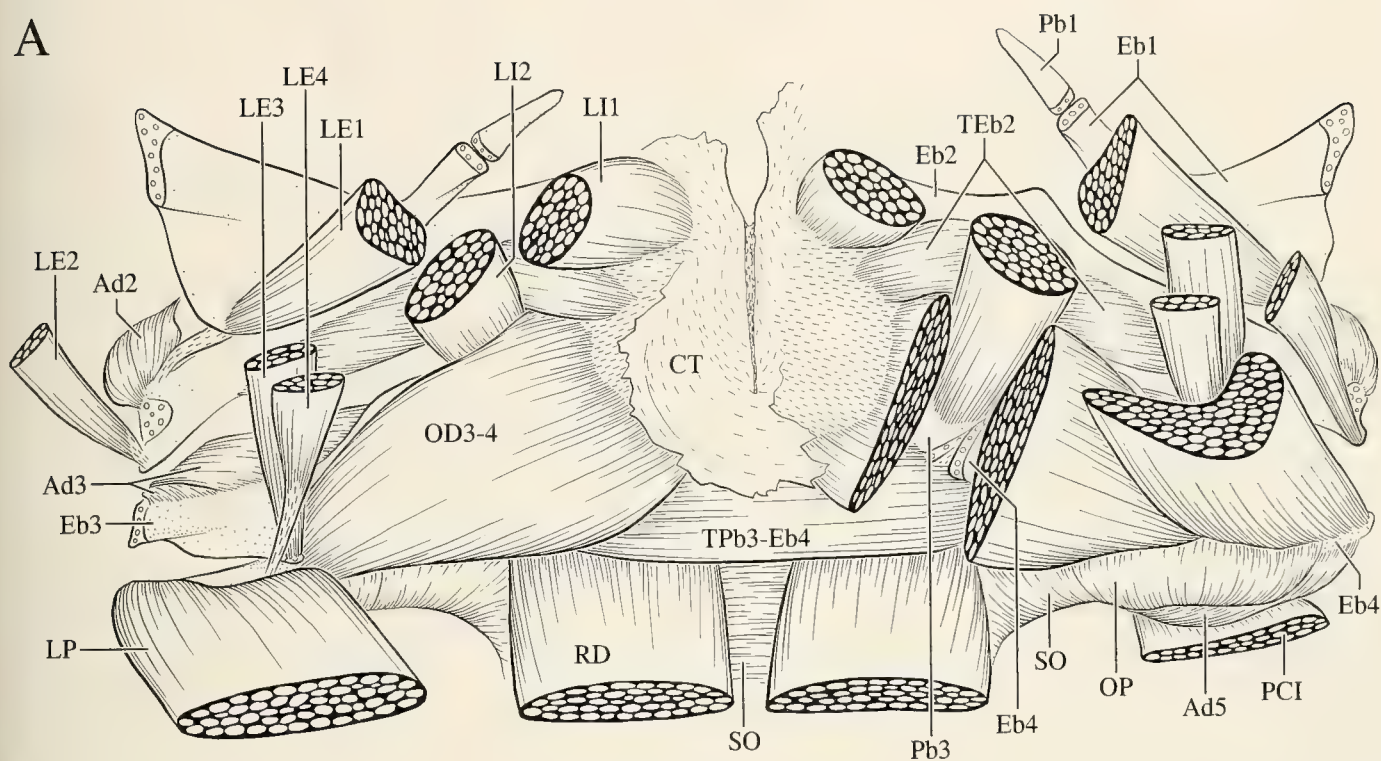


Plate 174. *Pristolepis fasciata*, USNM 103105: A, dorsal view, medial portion of right-side TEb2 and LE4 and LP removed (insertion positions shaded). B, right side reversed. C, lateral view (Ad1 damaged, extends from Eb1 just to dorsoanterior surface of distalmost end of Cb1).

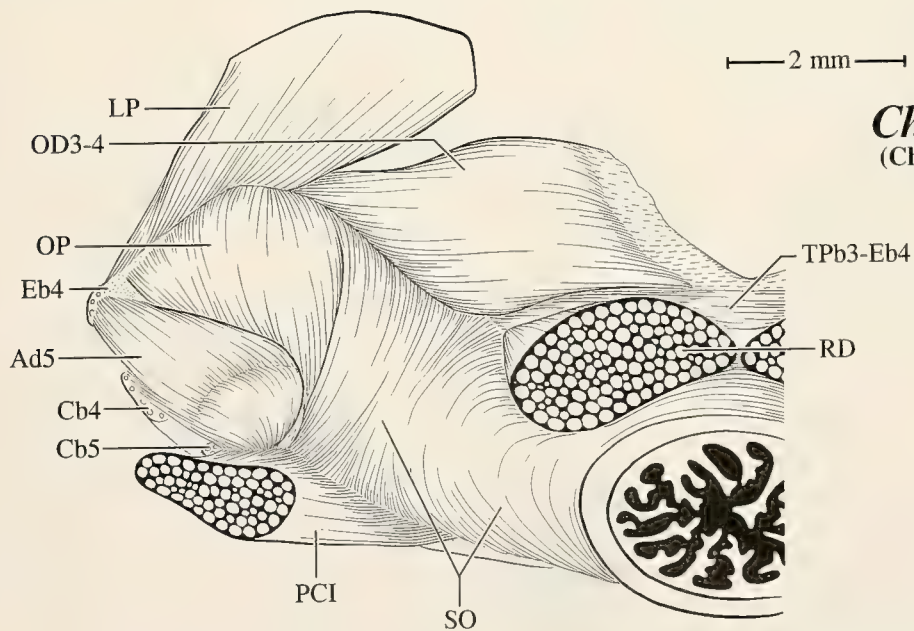




A



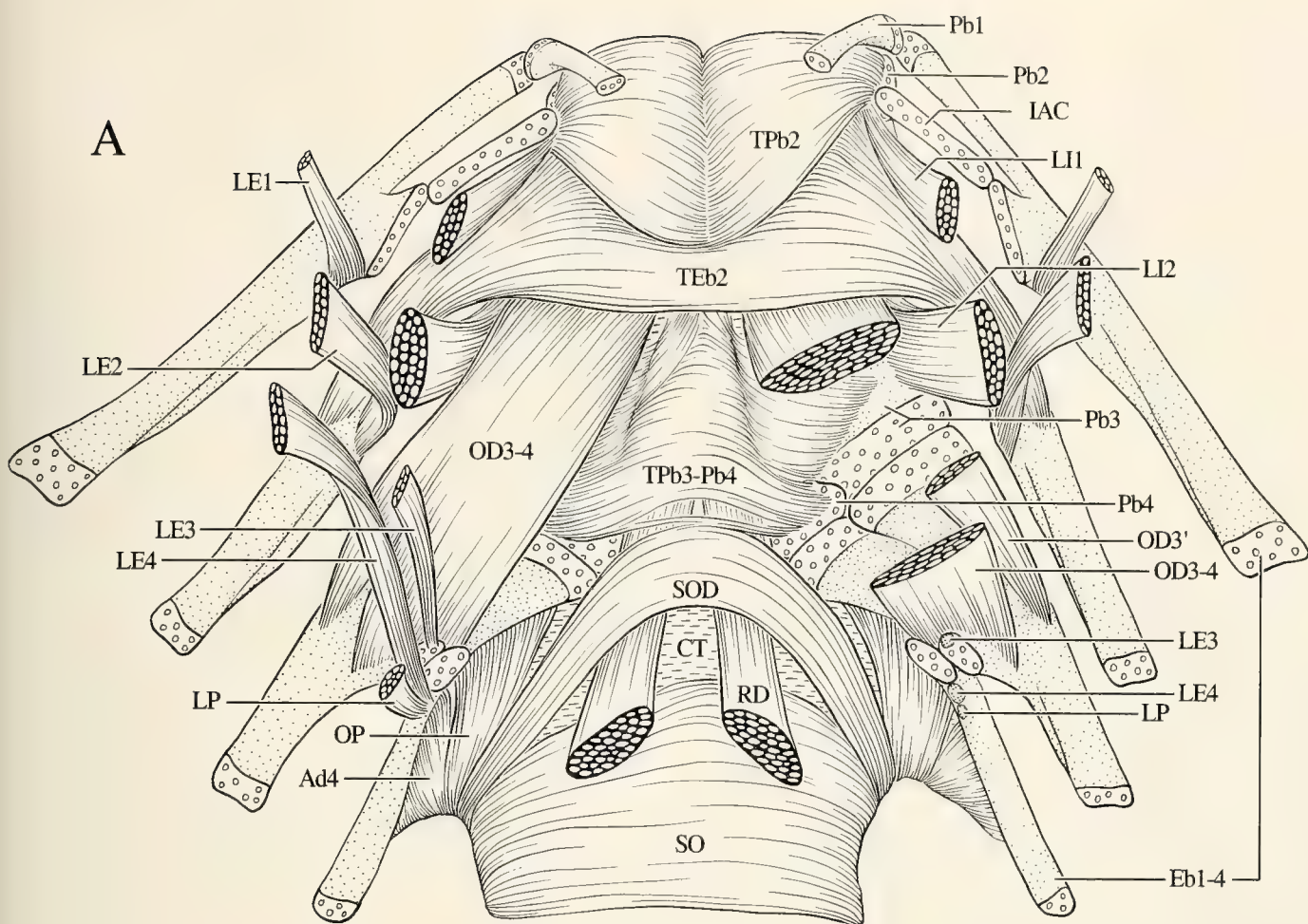
B



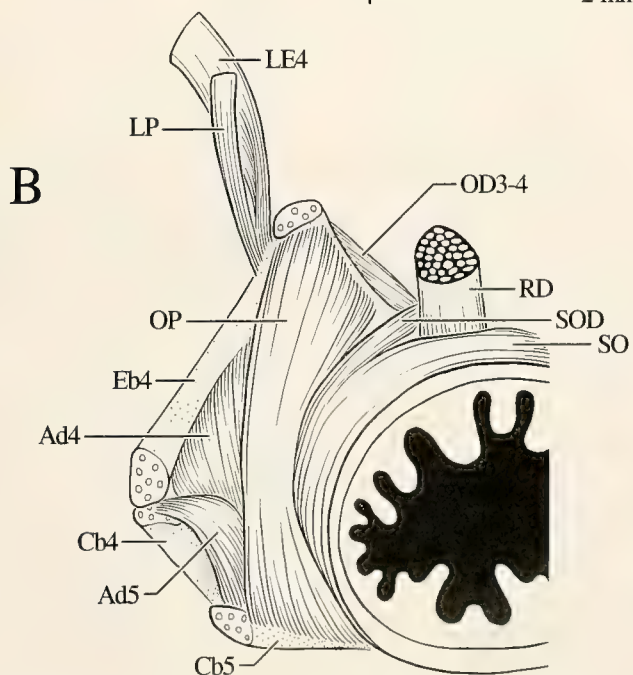
***Channa***  
(Channidae)

Plate 175. *Channa asiatica*, USNM 191304: A, dorsal view, right-side OD3-4 bisected and Eb1 moved slightly anteriorly (note: LI1 inserts on Pb3 dorsoanteromedially; see description). B, posterior view, left side; Ad5 and PCI insertions include distal tip of Cb5, which is exposed here.





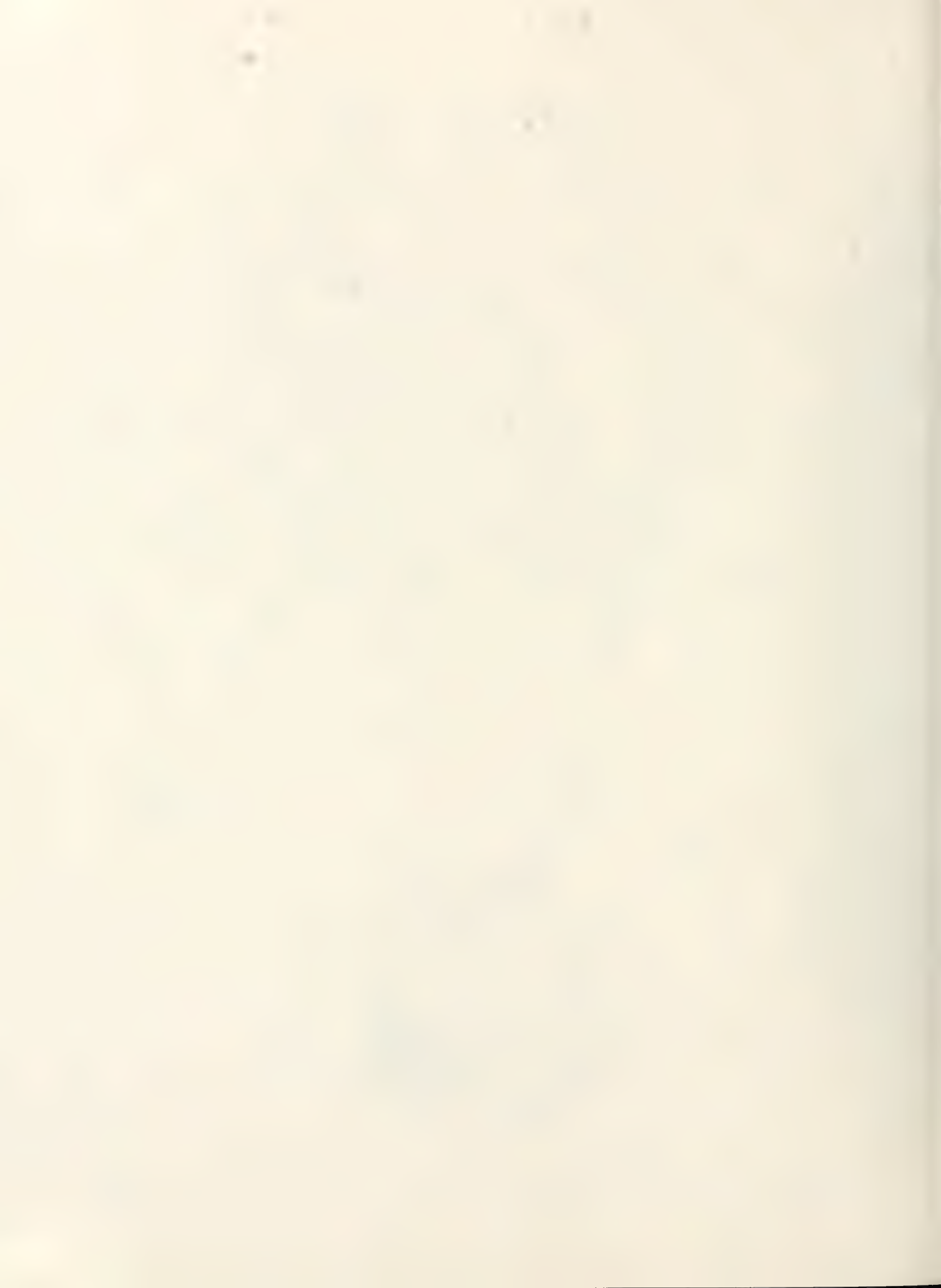
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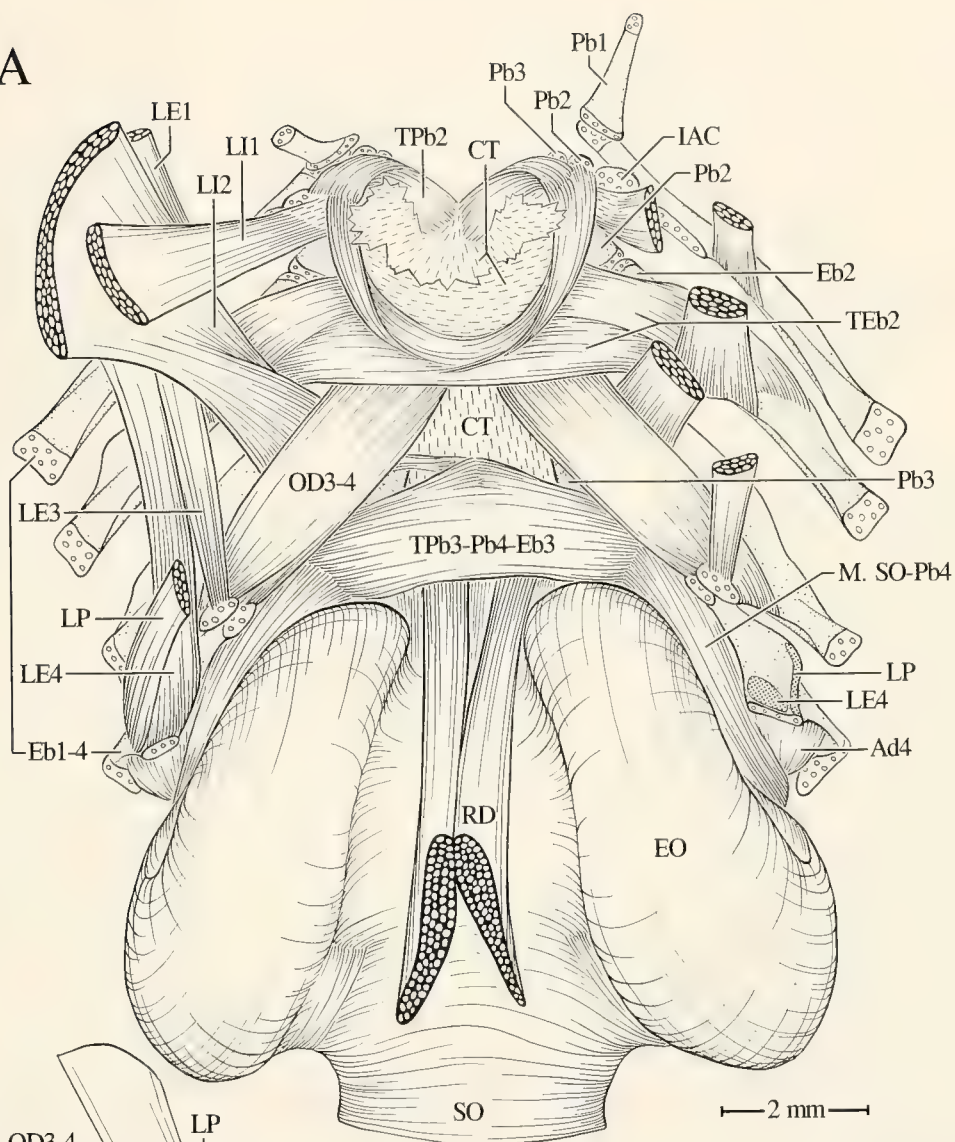
*Amarsipus*  
(Amarsipidae)

Plate 176. *Amarsipus carlsbergi*, SIO 75-116: A, dorsal view, right-side OD3' and OD3-4 cut away and LE3, LE4 and LP removed (insertion positions indicated by shading). B, posterior view, right side reversed.





A



*Psenopsis*  
(Centrolophidae)

B

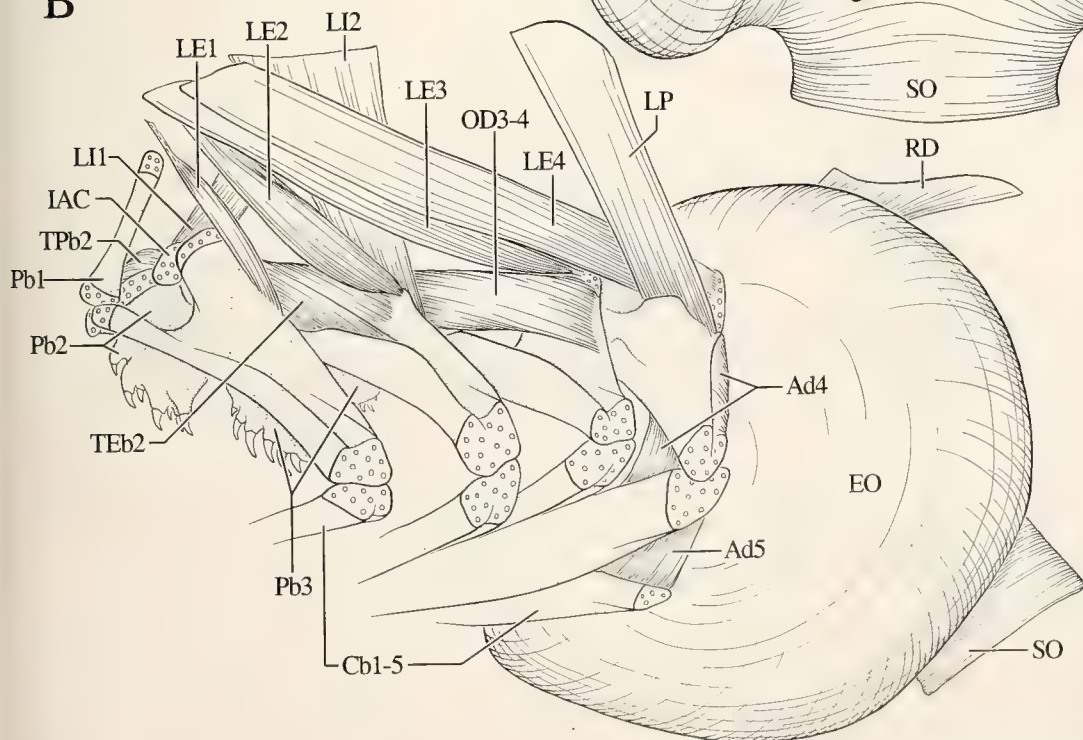


Plate 177. *Psenopsis* sp., USNM 304398: A, dorsal view, right-side Pb1 pivoted anteriorly and LE4 and LP removed (insertion positions indicated by shading). B, lateral view, left side.



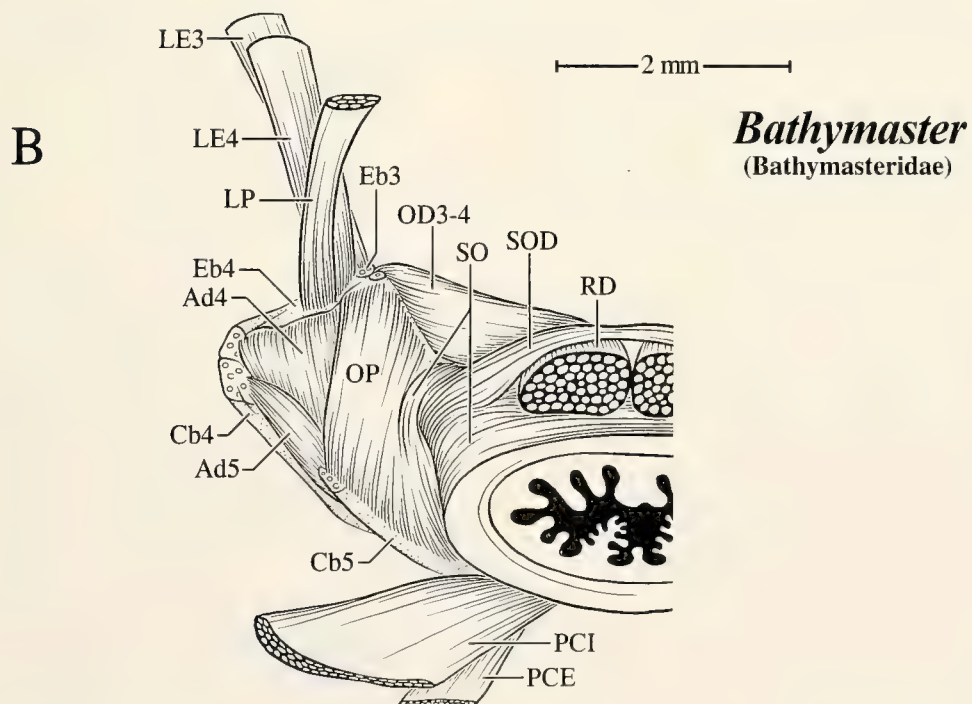
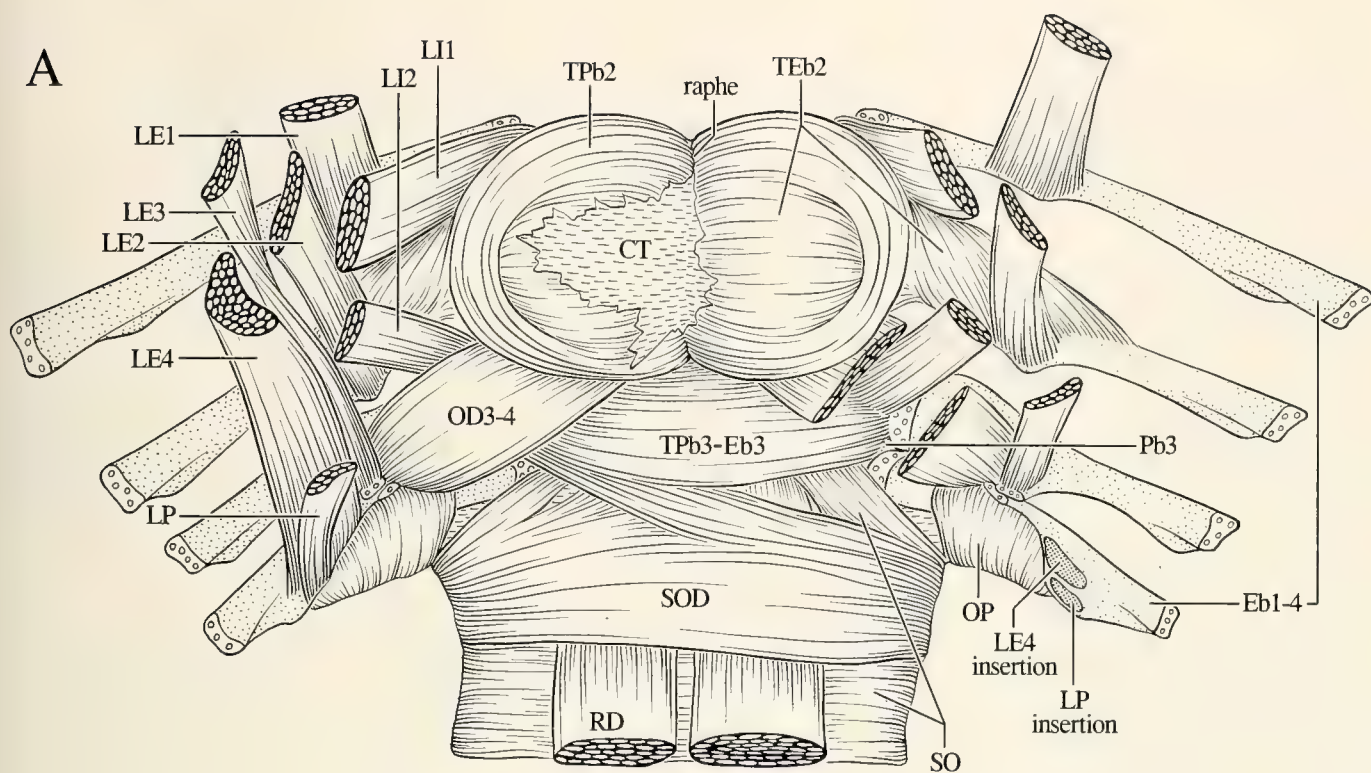
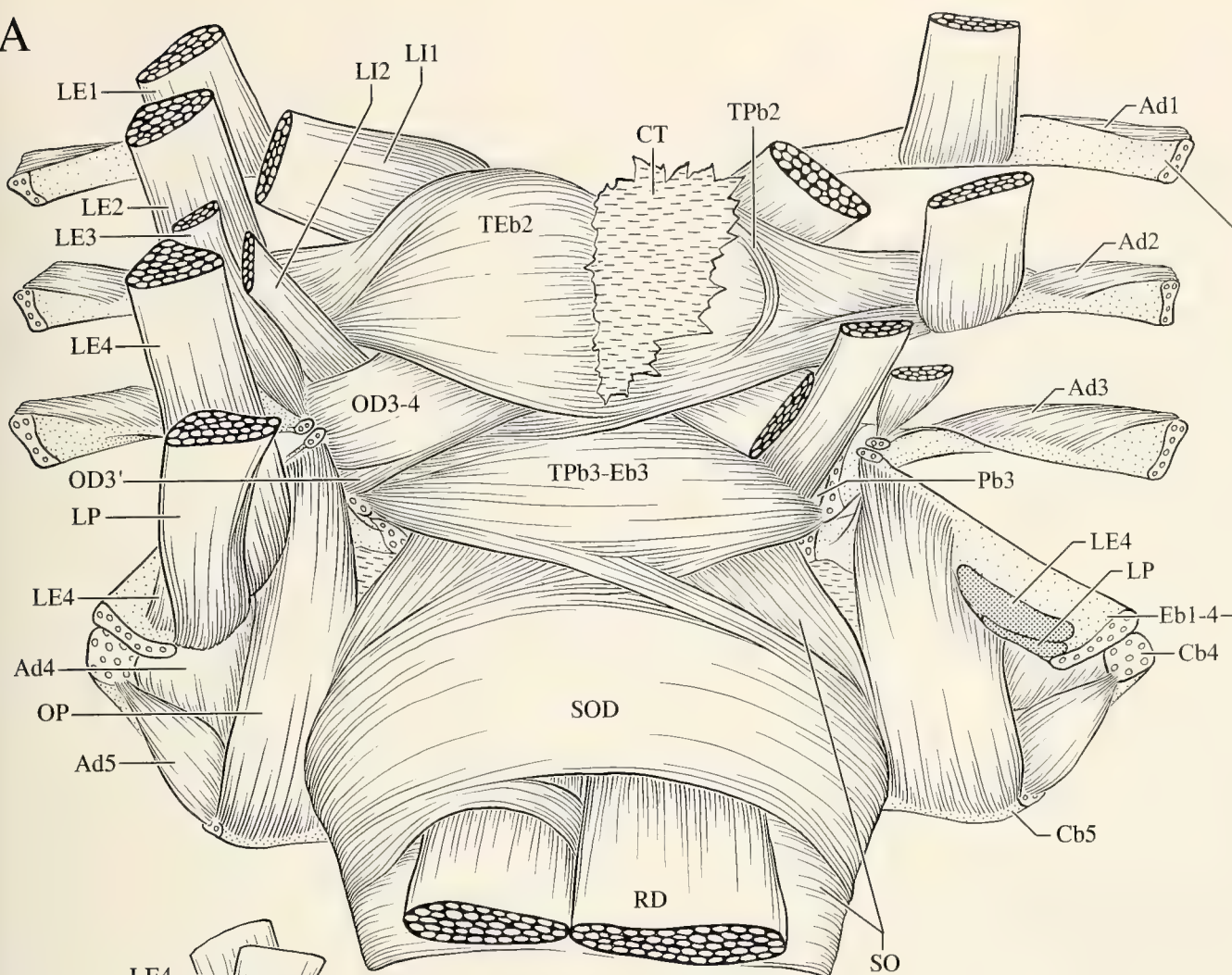


Plate 178. *Bathymaster signatus*, USNM 339381: A, dorsal view, right-side dorsal CT and OD3-4 cut away. B, posterior view, right side reversed.

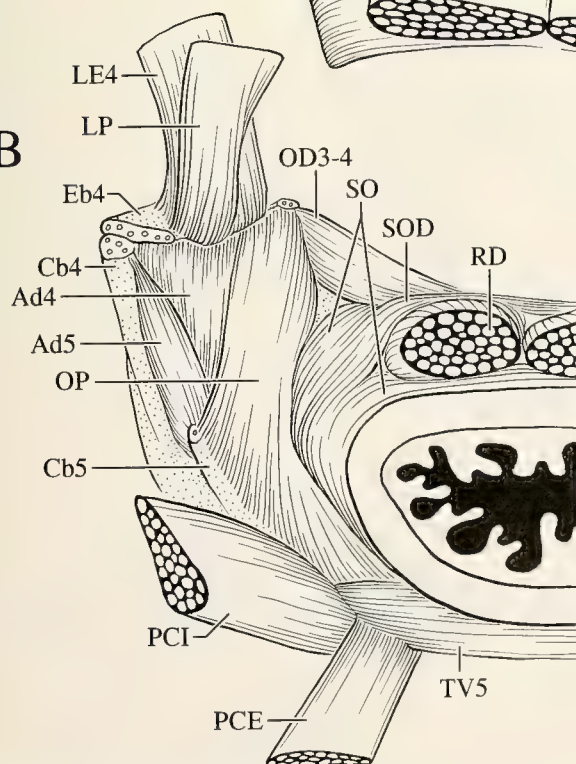




A



B

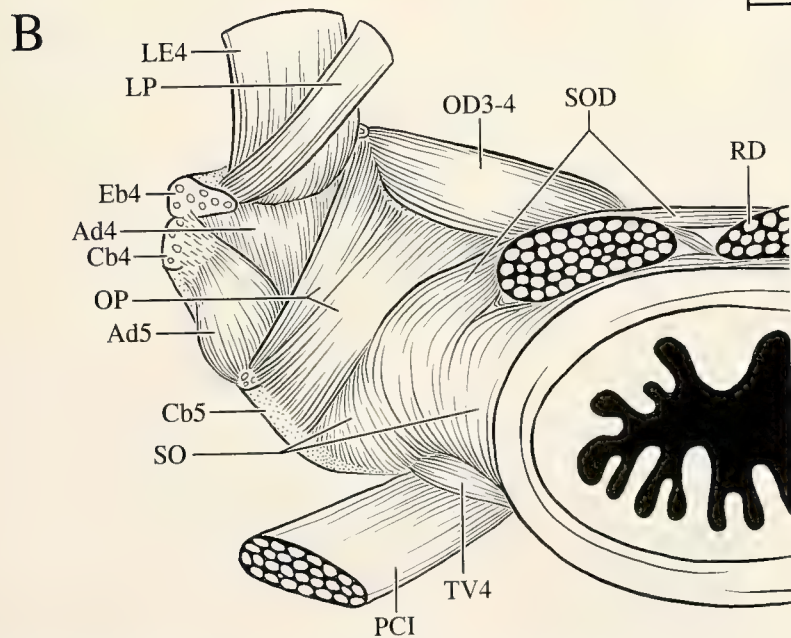
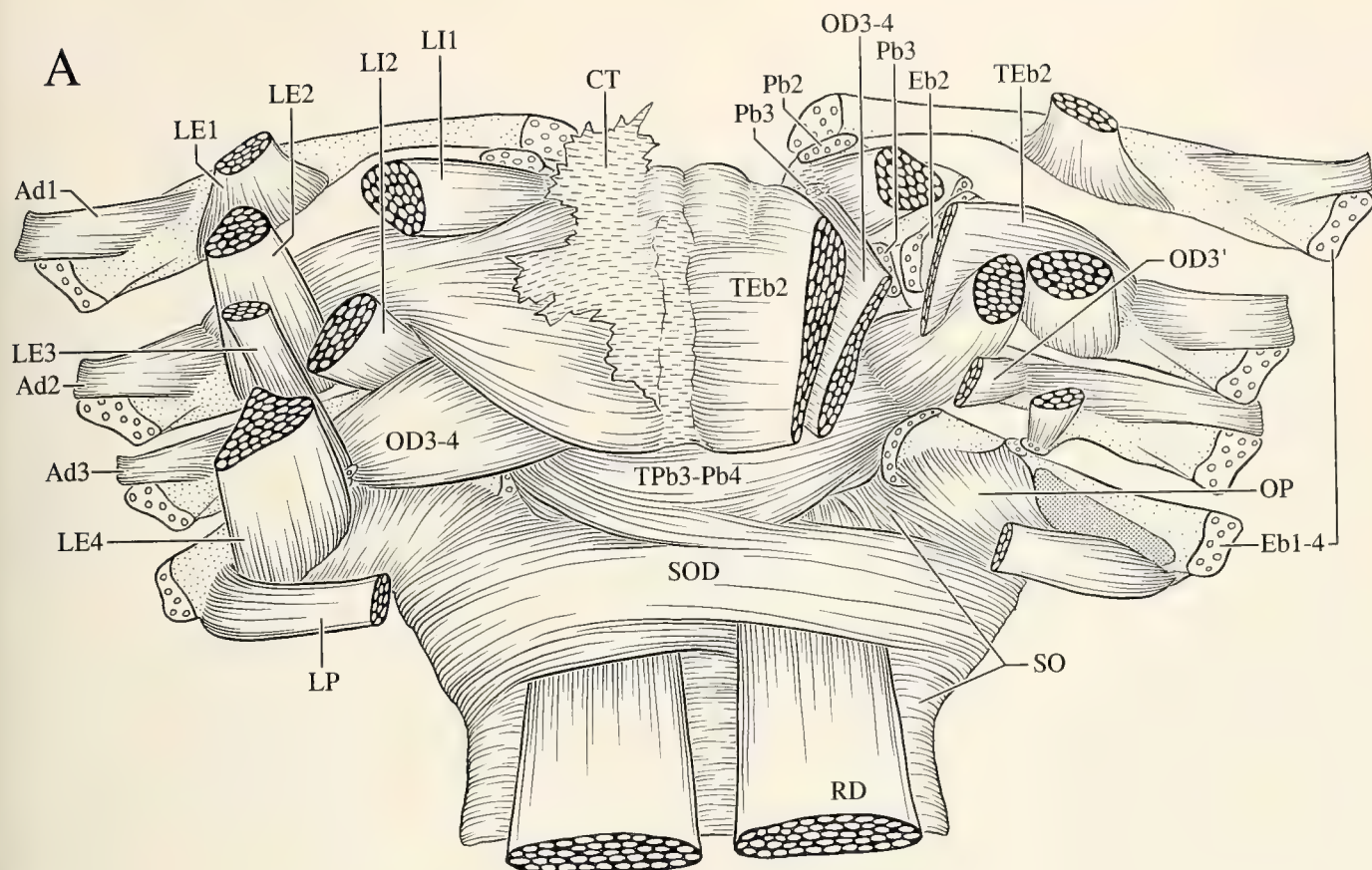


2 mm

*Ulvaria*  
(Stichaeidae)

Plate 179. *Ulvaria subbifurcata*, USNM 364344: A, dorsal view, right-side OD3-4 cut away; LE4 and LP removed (insertion positions indicated by shading). B, posterior view, left side.



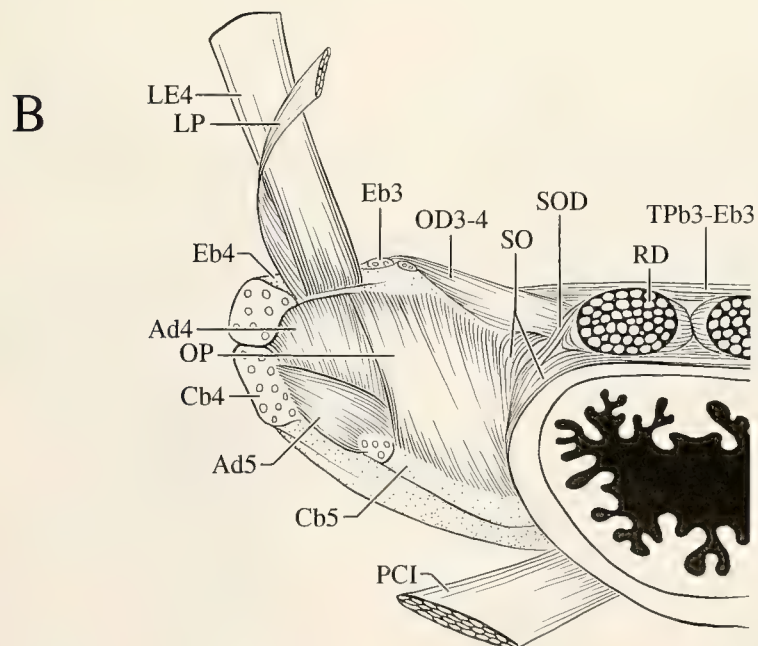
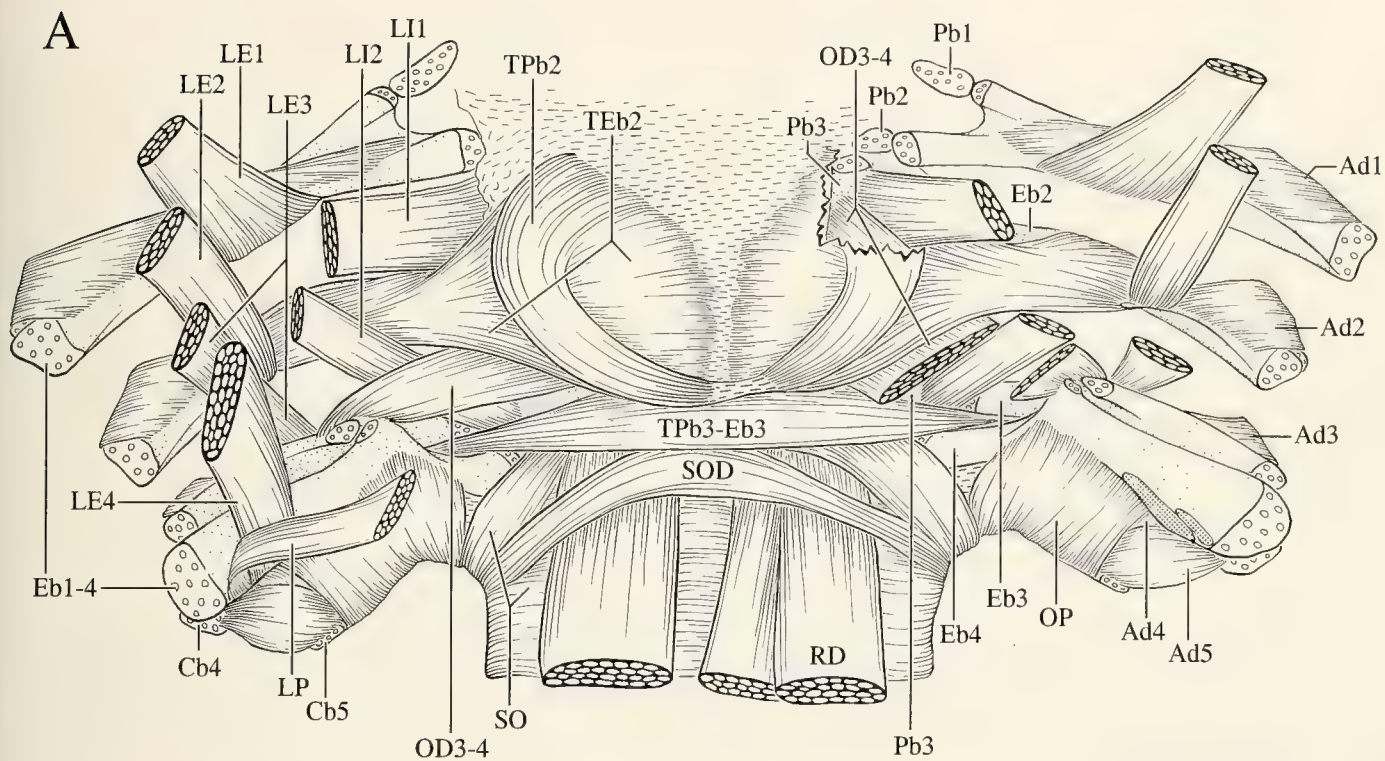


***Bovichtus***  
(Bovichtidae)

Plate 180. *Bovichtus veneris*, USNM 200412: A, dorsal view, right-side TEb2 and OD3-4 cut away, LE4 and LP removed (joined insertion positions indicated by shading). B, posterior view, right side reversed.







*Dactyloptena*  
(Dactylopteridae)

Plate 181. *Dactyloptena macracantha*, USNM 224473: A, dorsal view, right-side OD3-4 and anterior portion of TPb2 and TEb2 cut away and LE4 and LP removed (insertion positions indicated by shading). B, posterior view, left side.



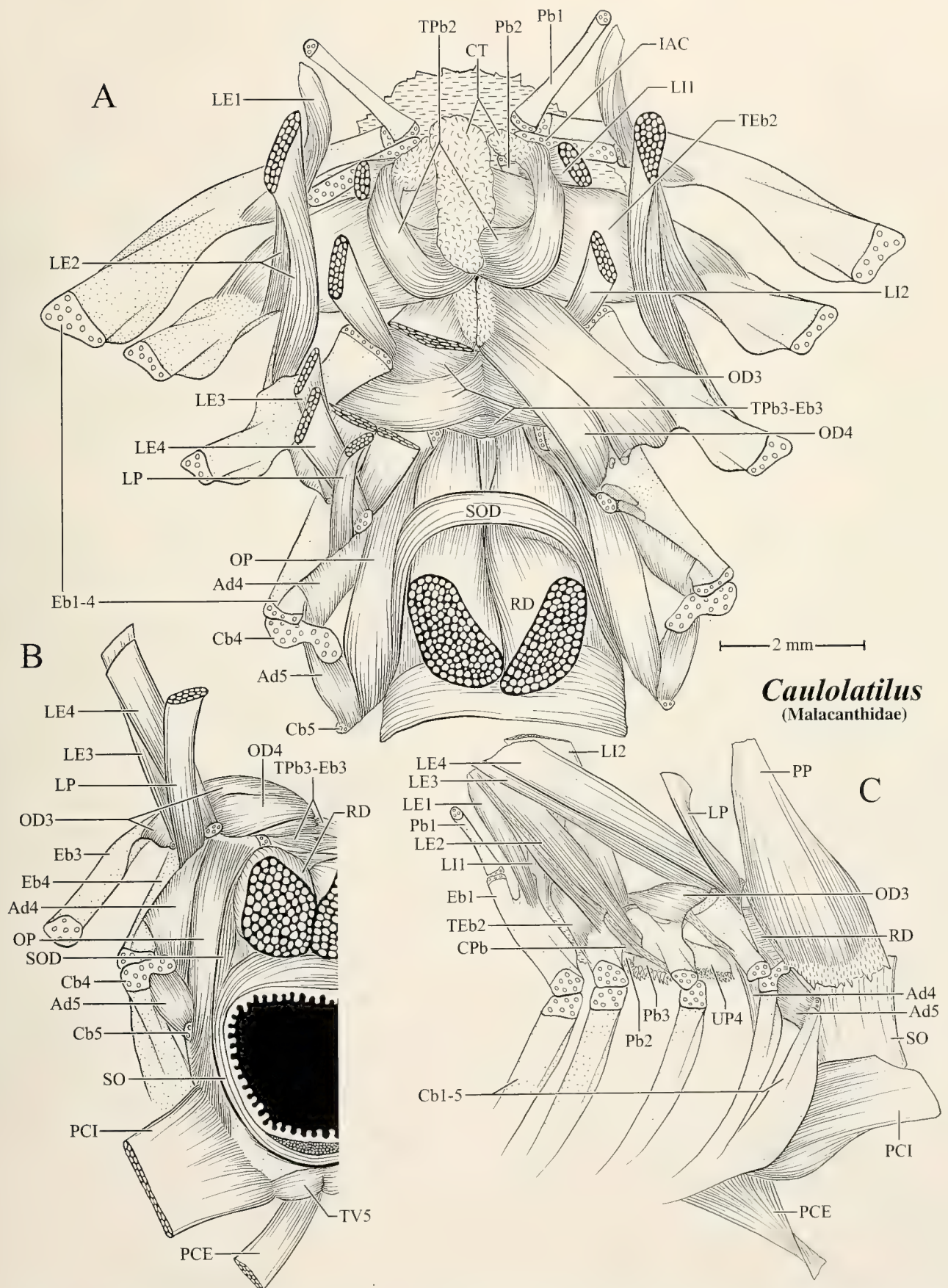


Plate 182. *Caulolatilus affinis*, USNM 211424: A, dorsal view; left-side OD bisected, right-side LE3, LE4, and LP removed, insertion positions shown by shading. B, posterior view, left side; PP added from right side. C, lateral view, right side reversed.





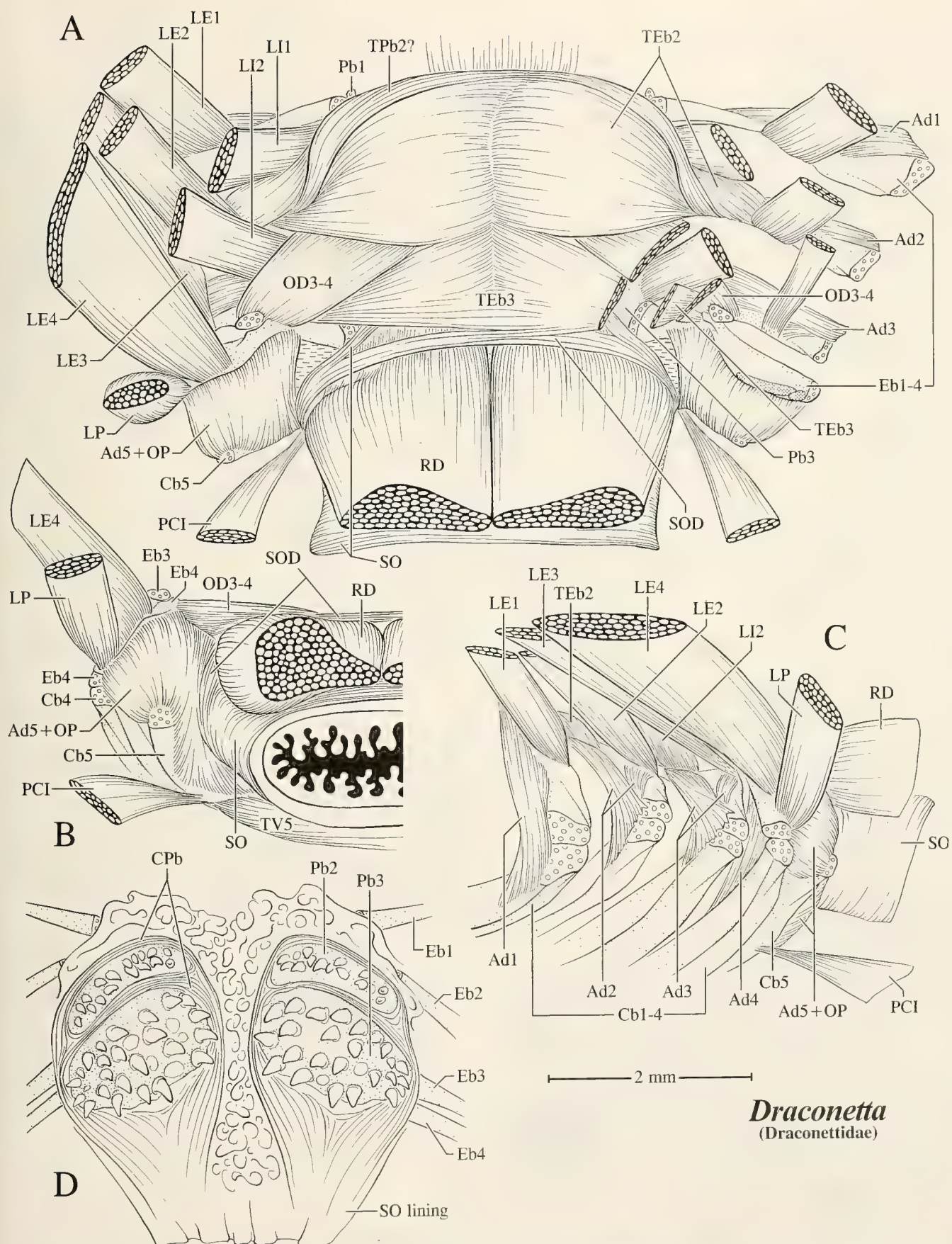
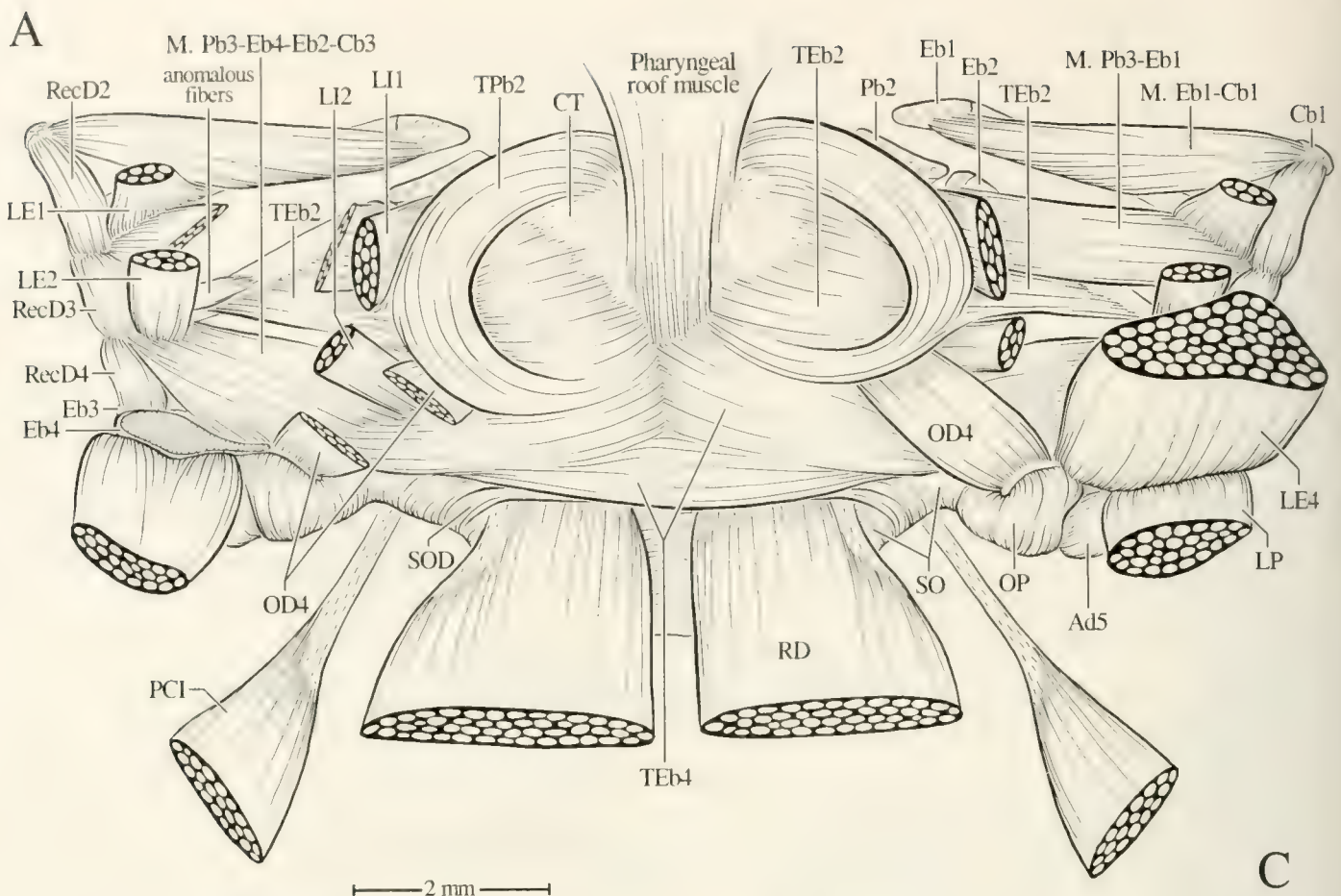
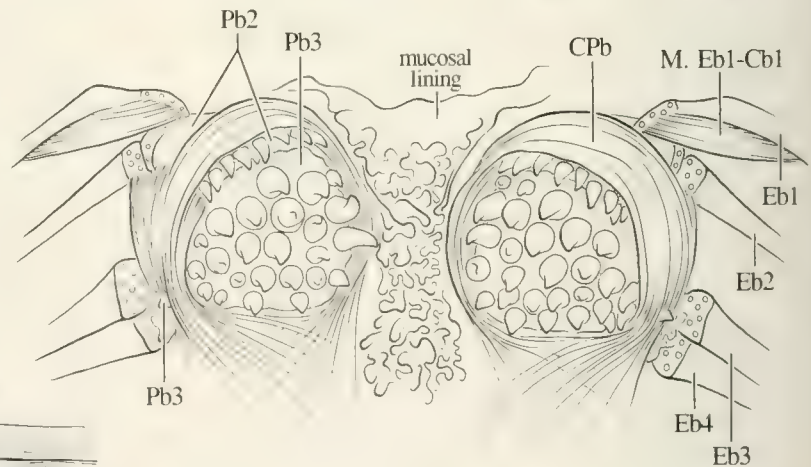
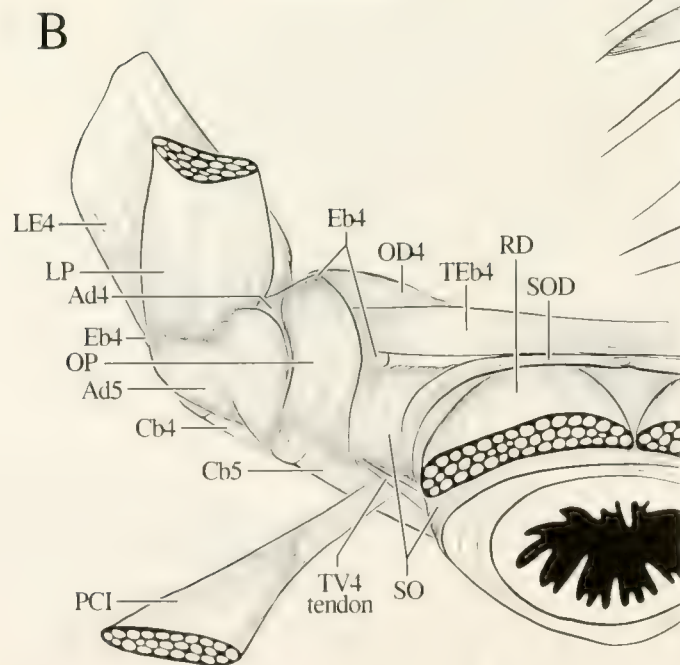


Plate 183. *Draconetta oregona*, USNM 159234: A, dorsal view, right-side LE4 and LP removed (insertion positions indicated by shading) and OD3-4 bisected; TPb2 problematic (see description for discussion). B, posterior view, right side reversed. C, lateral view, right side reversed. D, ventral view of pharyngeal area.



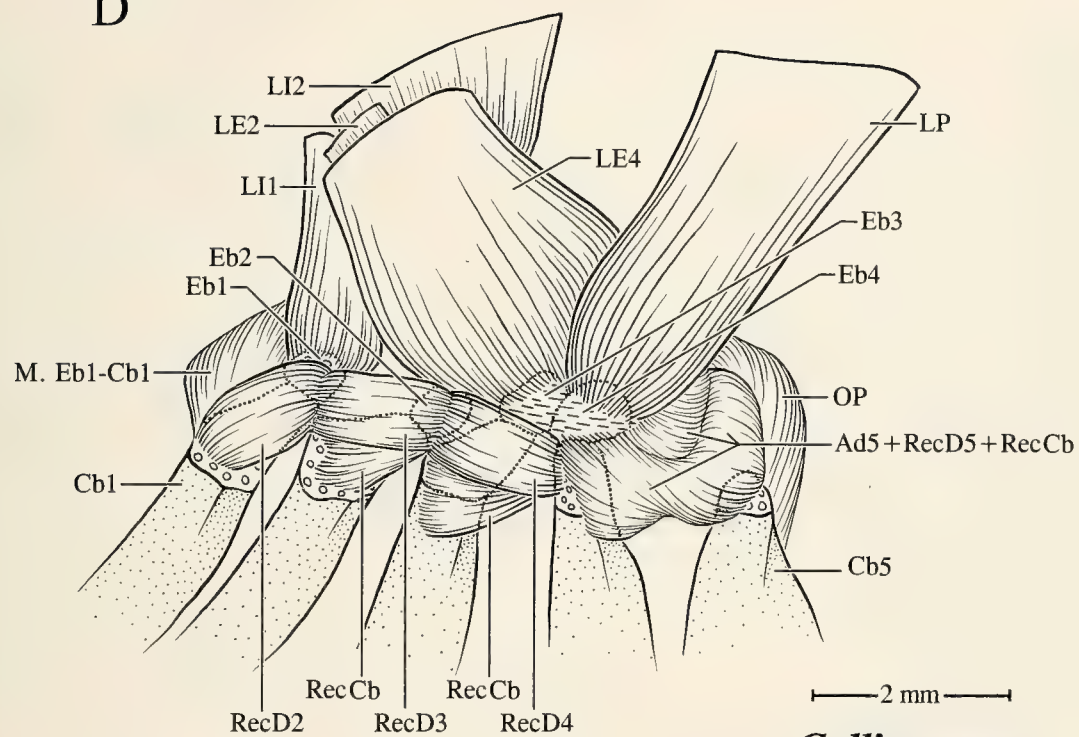
***Callionymus***  
(Callionymidae)



Plates 184.1, 184.2. *Callionymus lyra*, USNM 197584: A, dorsal view, left-side M. Pb3-Eb1 and OD4 bisected and LE3-4 removed (joint insertion position indicated by shading); aberrant muscle fibers extend from Eb2 mid-dorsally to CT at anterior edge of LE2 insertion (illustrated specimen only); Pb2 normally not visible dorsally. B, posterior view, left side. C, ventral view, left-side ventrolateral CPb fibers removed to reveal attachments of CPb to Eb2 and Pb2. D, lateral view, right side reversed, dotted lines indicate extent of cartilaginous distal ends of Ebs and Cbs obscured by overlying muscles and CT.



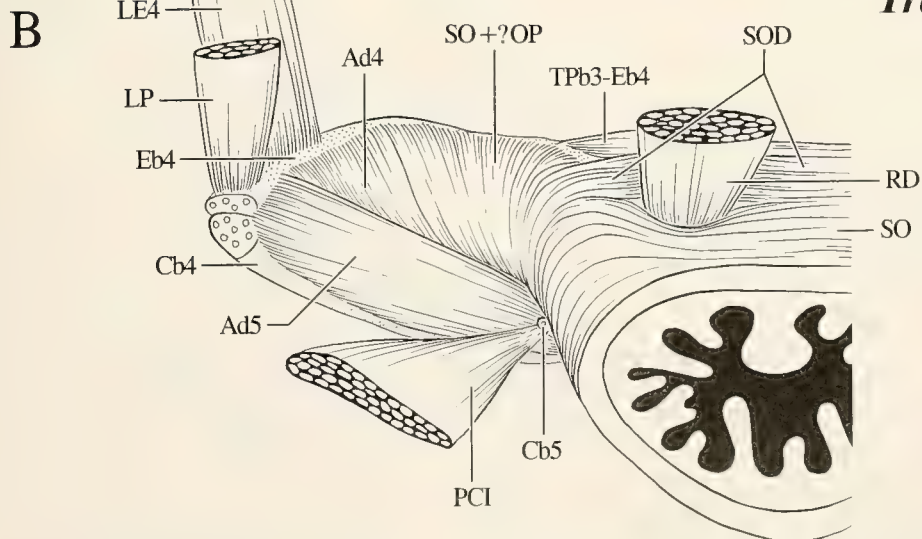
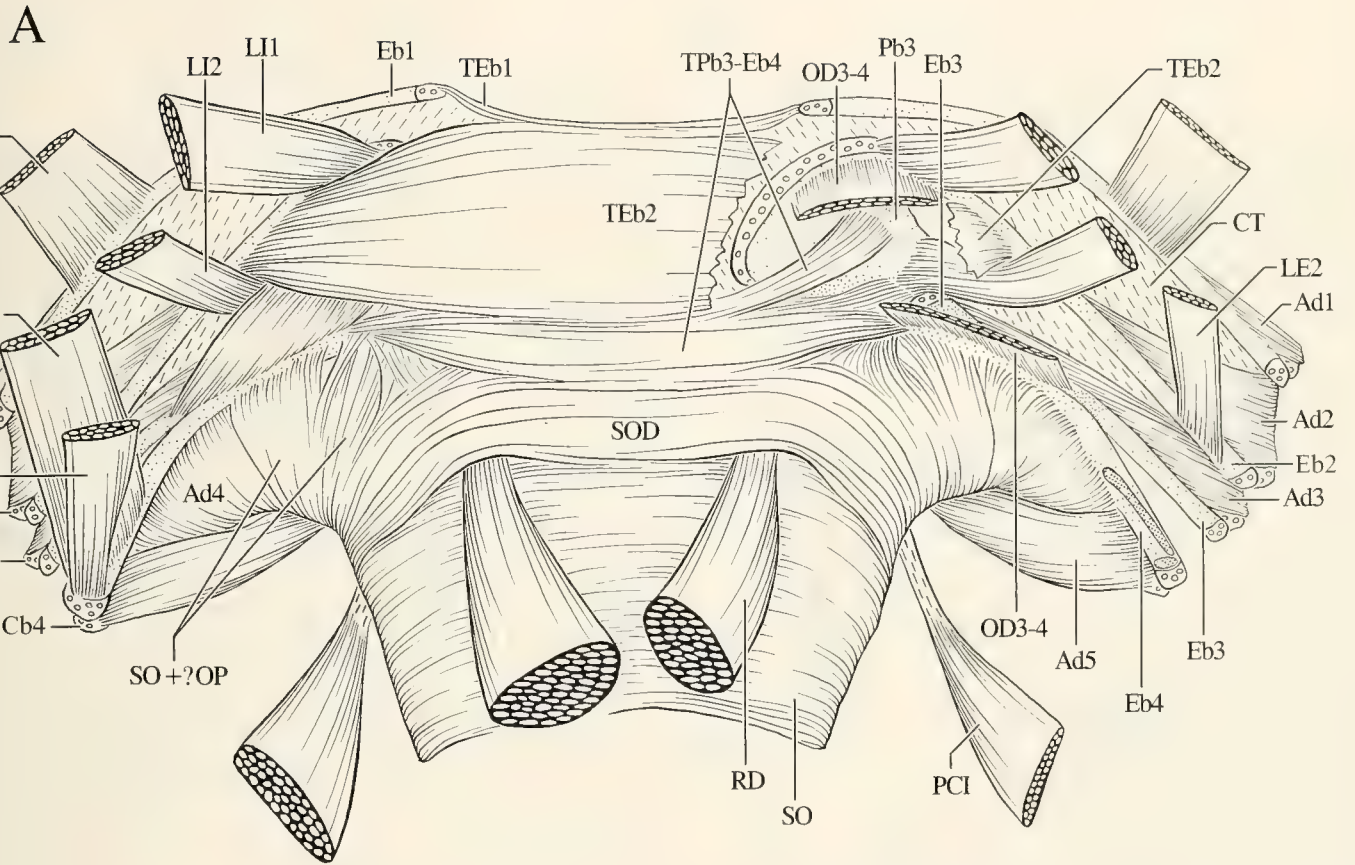
D



*Callionymus*







*Trachelochismus*  
(Gobiesocidae)

Plate 185. *Trachelochismus* sp., USNM 339196: A, dorsal view right-side of TEb2 cut away, OD3-4 bisected, and LE4 and LP removed (insertion positions indicated by shading). B, posterior view, left side.



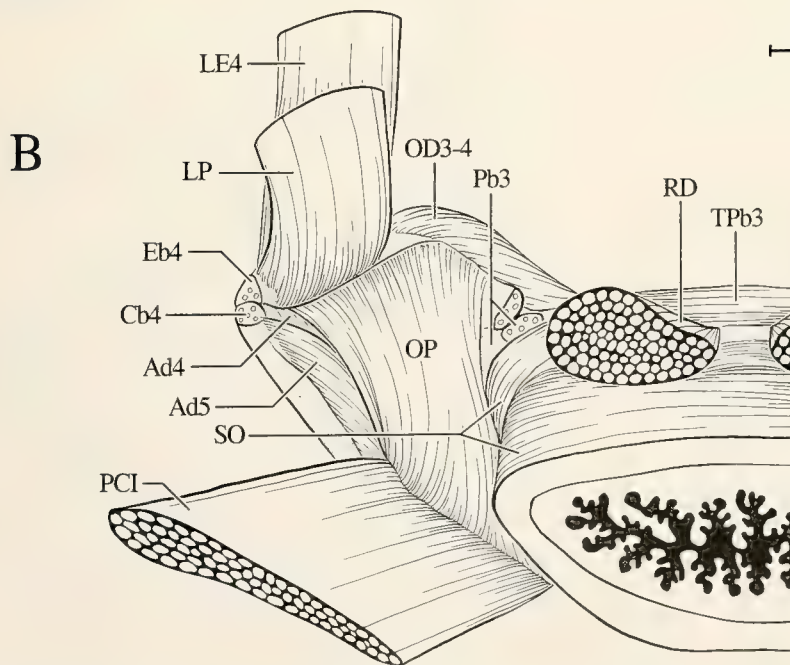
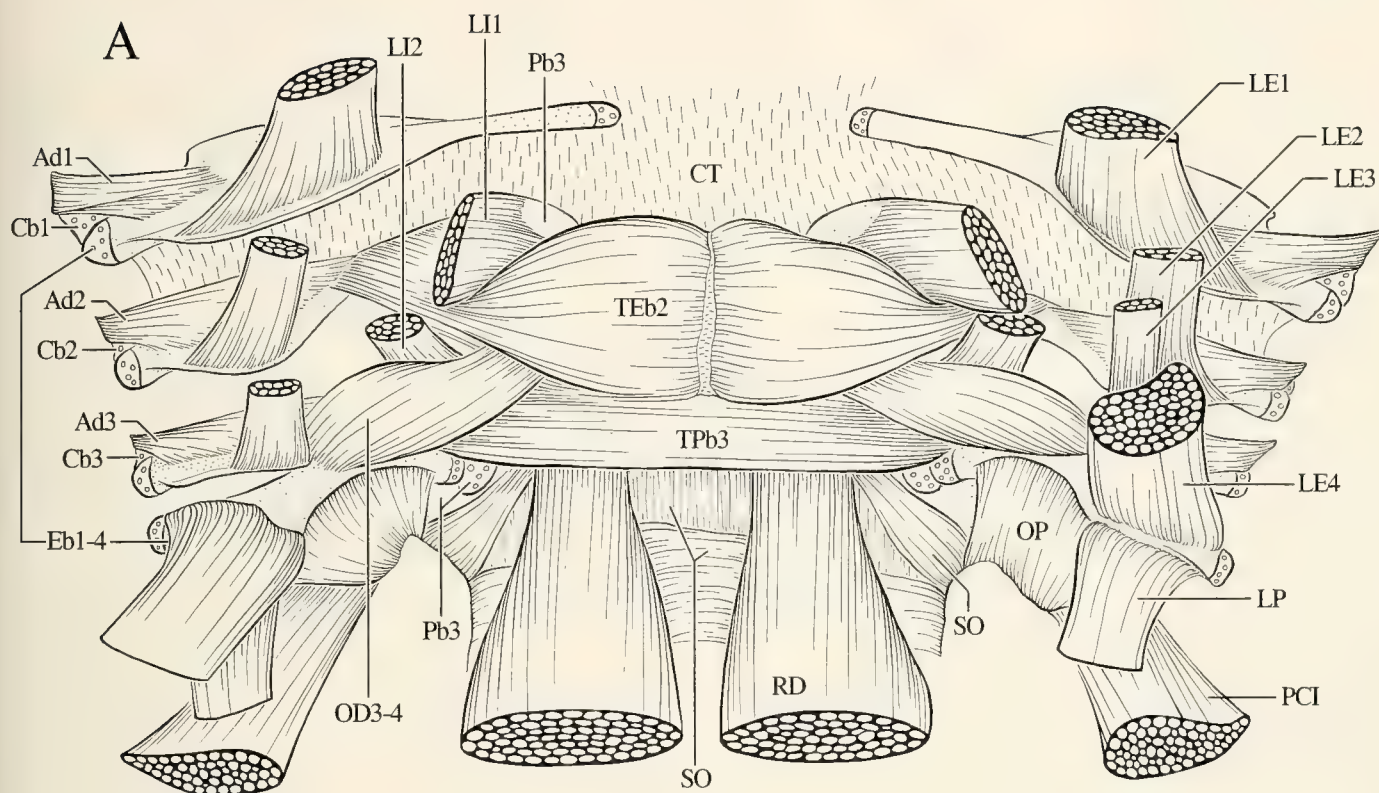
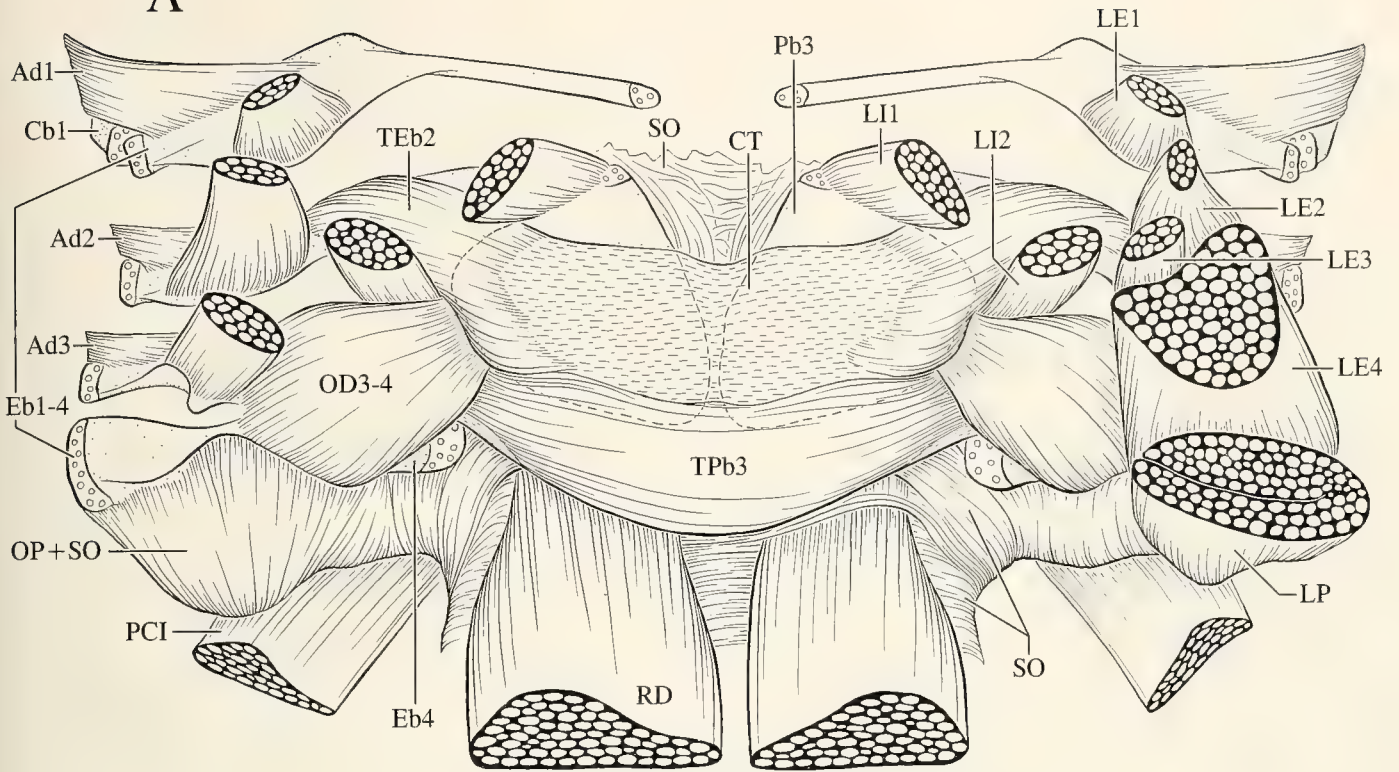


Plate 186. *Ruanoho decemdigitatus*, USNM 297745: A, dorsal view, left-side LE4 and LP, right-side LP retracted. B, posterior view, LP pulled anteriorly.





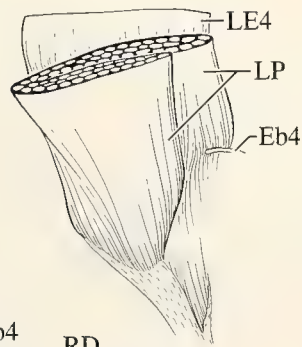
A



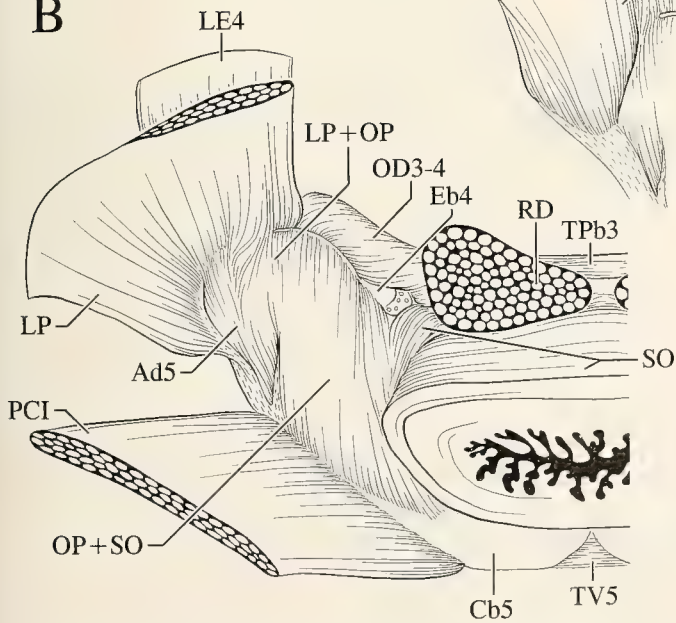
2 mm

*Lepidoblennius*  
(Tripterygiidae)

C



B



D

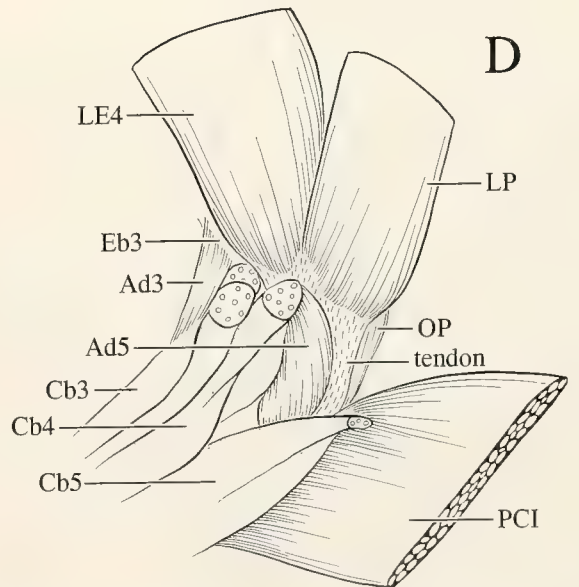
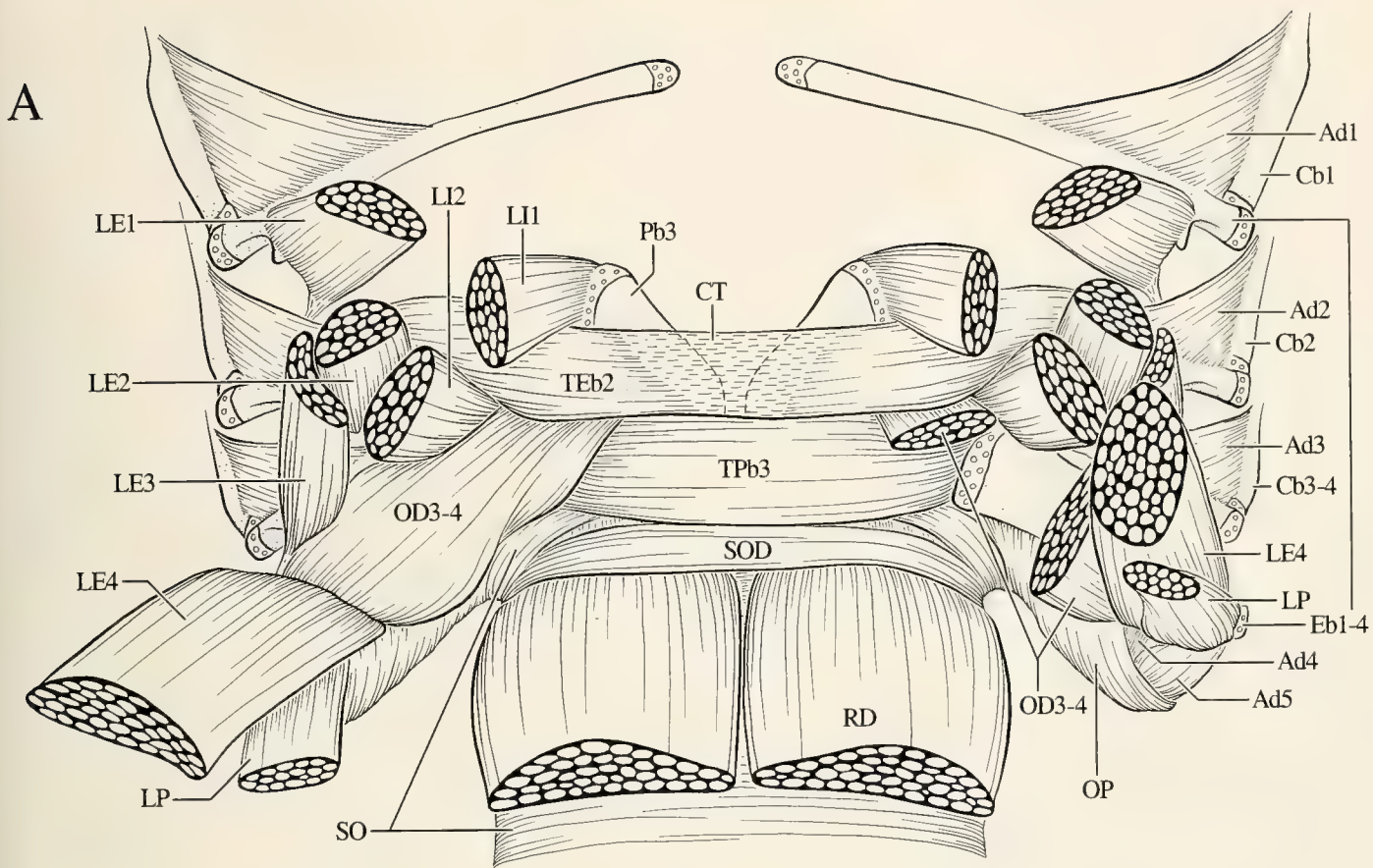


Plate 187. *Lepidoblennius marmoratus*, USNM 201625: A, dorsal view, left-side LE4 and LP removed, dashed lines indicate outline of Pb3 ventral to TEb2. B, posterior view, left side, LP posterior fold rotated clockwise to reveal "sling" comprising LP and OP. C, posterior view, left side, LP in normal position. D, lateral view, posterior elements, to show position of AD5 in LP/OP complex and tendinous connections of LE4 and LP (Ad4 occluded in all external views).





*Parablennius*  
(Blenniidae)

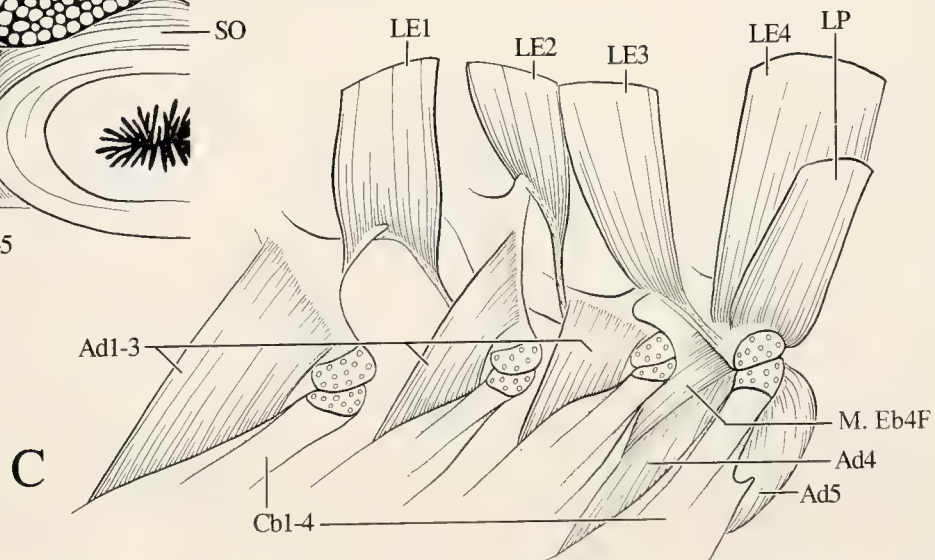
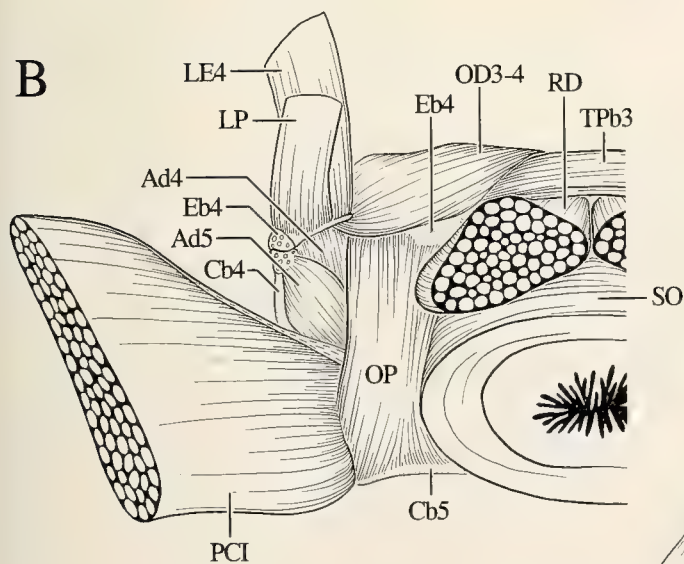
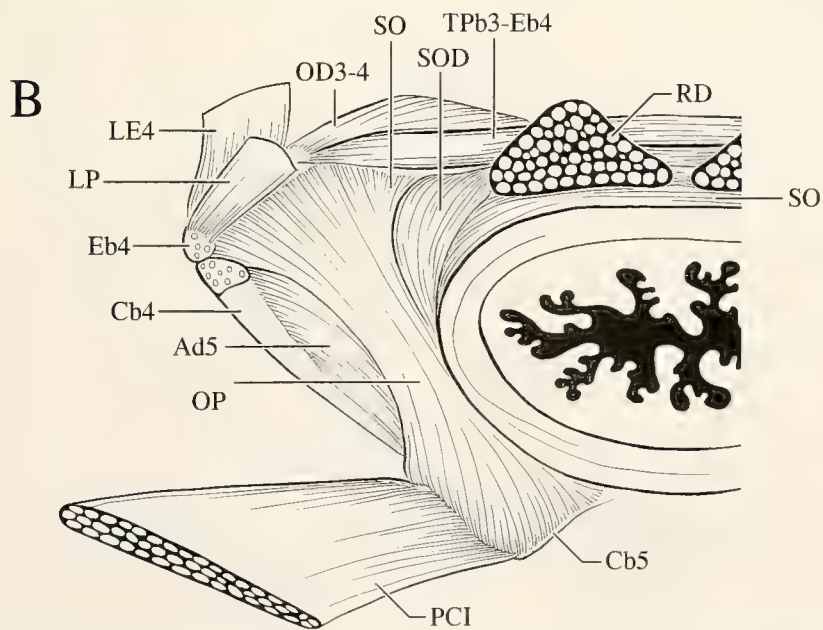
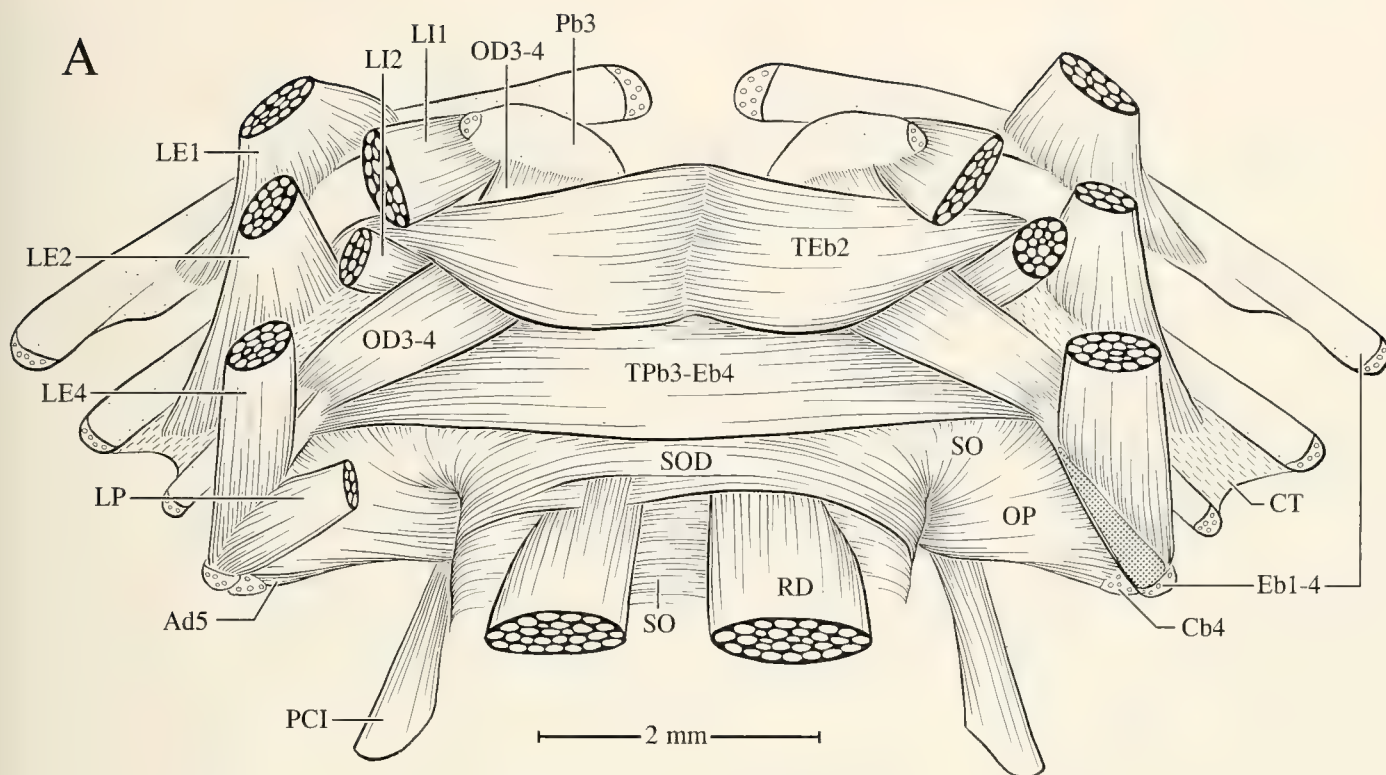


Plate 188. *Parablennius gattorugine*, USNM 276284: A, dorsal view, left-side LE4 and LP pulled posteriorly, right-side OD3-4 bisected. B, posterior view, left side. C, lateral view, left side.



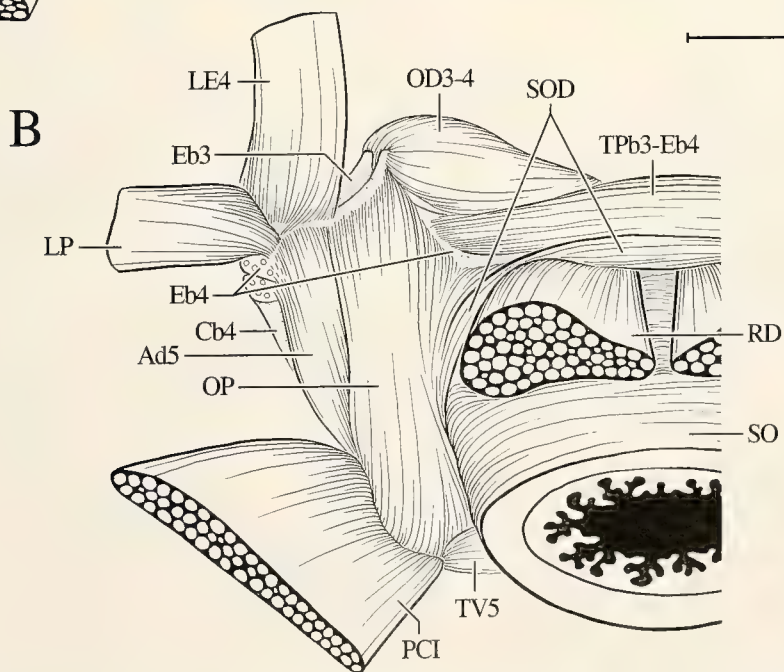
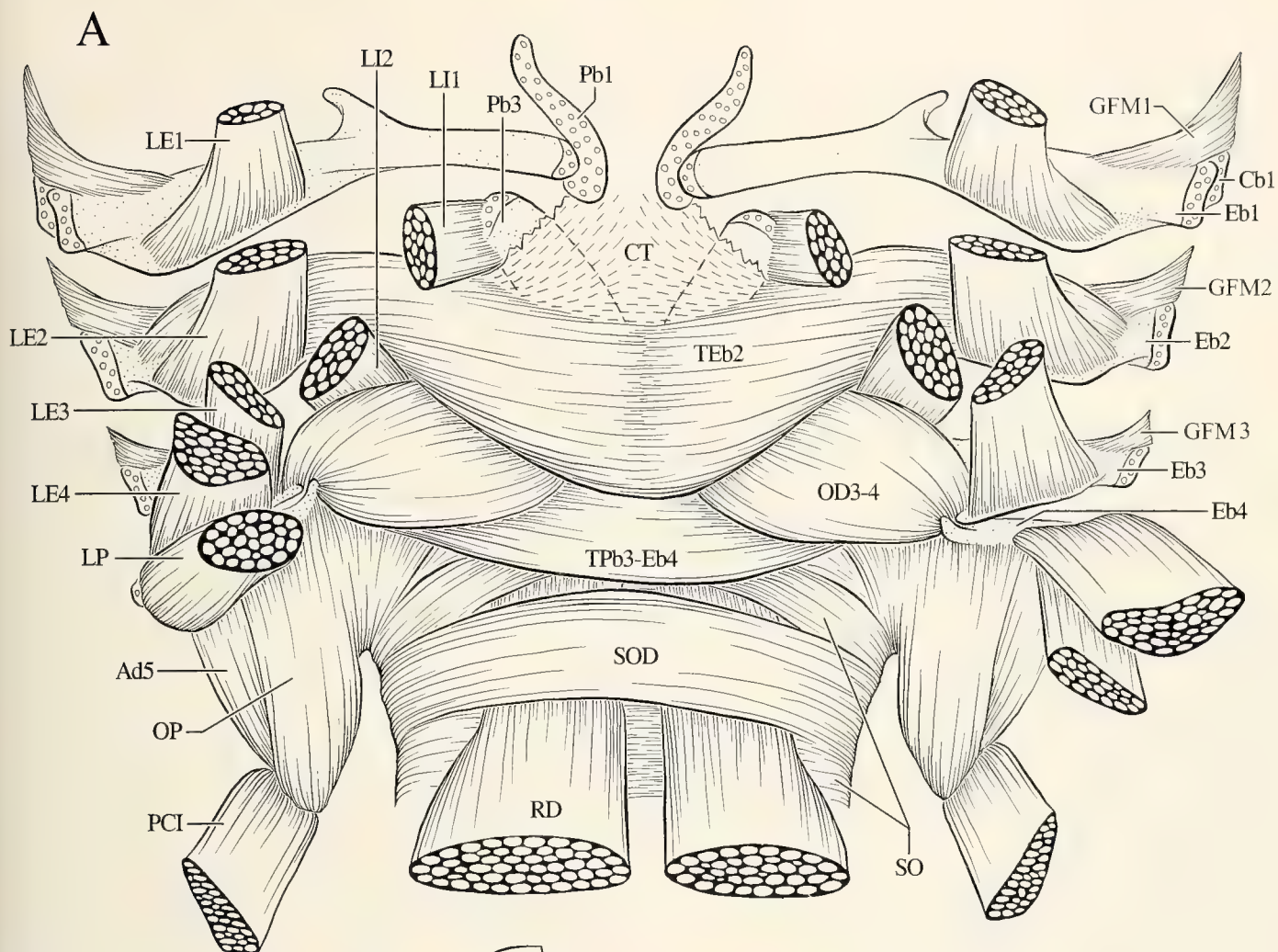




*Dactylagnus*  
(Dactyloscopidae)

Plate 189. *Dactylagnus mundus*, USNM 205741: A, dorsal view, right-side LP removed (insertion position indicated by shading). B, posterior view, left side (Ad4 not visible).



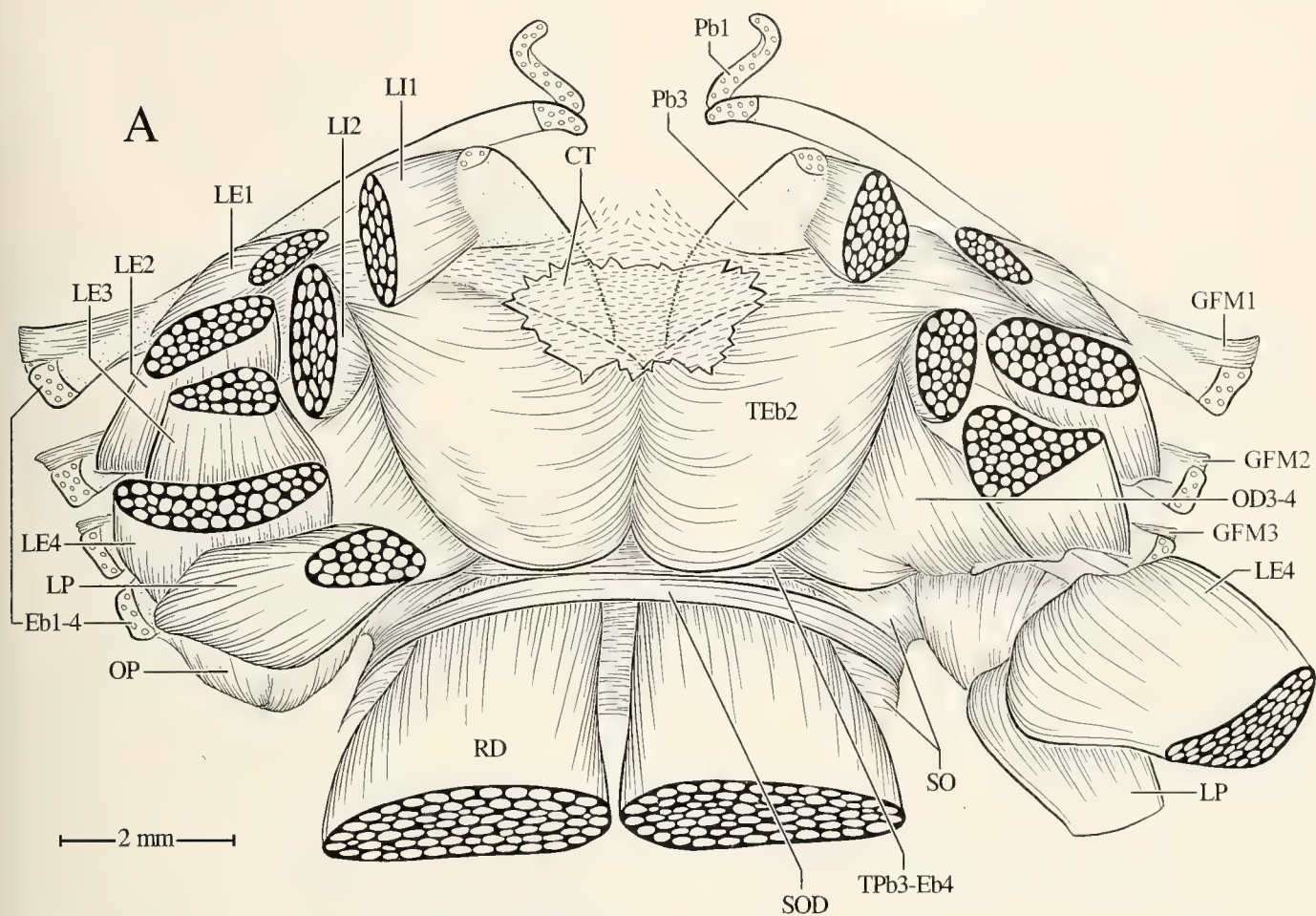


***Gibbonsia***  
(Clinidae, Myxodinae)

Plate 190. *Gibbonsia elegans*, USNM 152005: A, dorsal view, right-side LP and LE4 retracted, medial margins of Pb3 facets indicated beneath CT; (GFMs 1 and 2 relatively much smaller than illustrated); B, posterior view, left side (note: right-side LE4 joins broad raphe with OP on one side of one of two specimens).







***Heteroclinus***  
(Clinidae: Clininae)

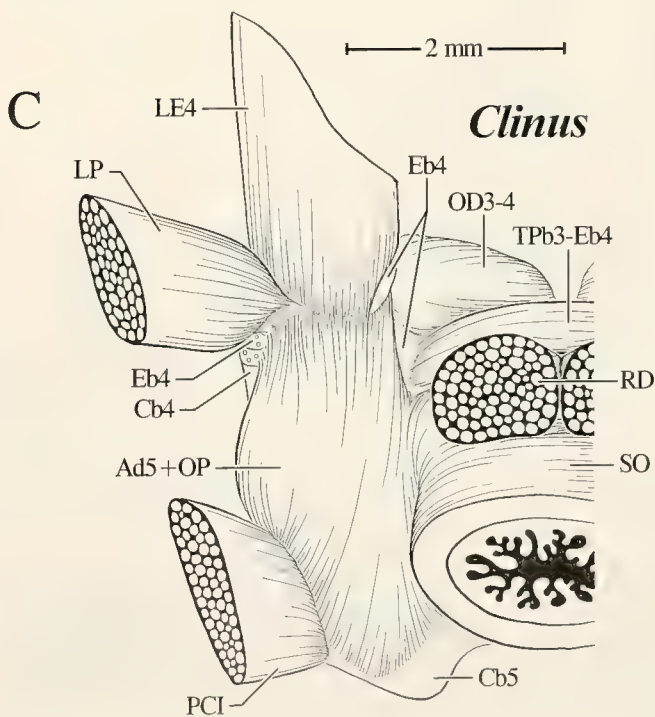
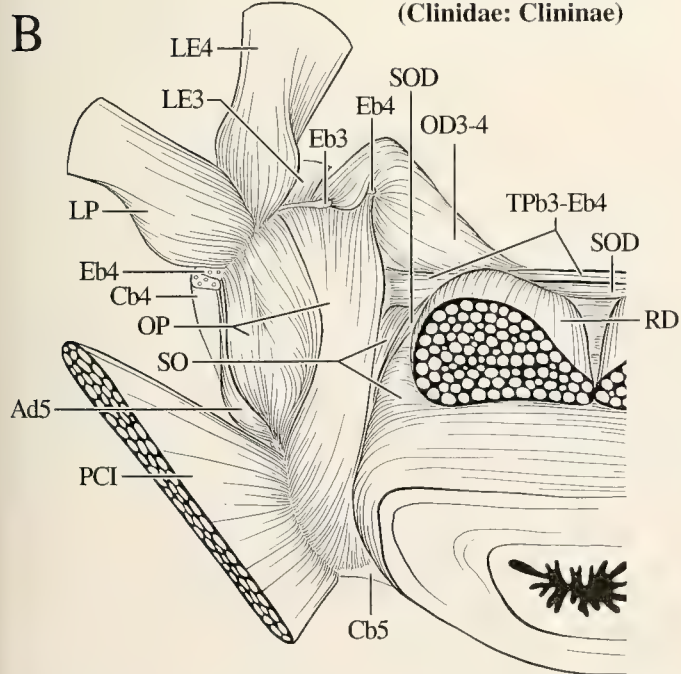


Plate 191. A, B, *Heteroclinus perspicillatus*, USNM 201518: A, dorsal view, medial margins of Pb3 facets indicated by dotted lines and anteromedial limit of TEB2 indicated by dashed line ventral to CT. B, posterior view, right side reversed; note LP and OP form sling. C, *Clinus acuminatus*, USNM 199579: posterior view, left side, LP retracted; note LP and OP form sling.



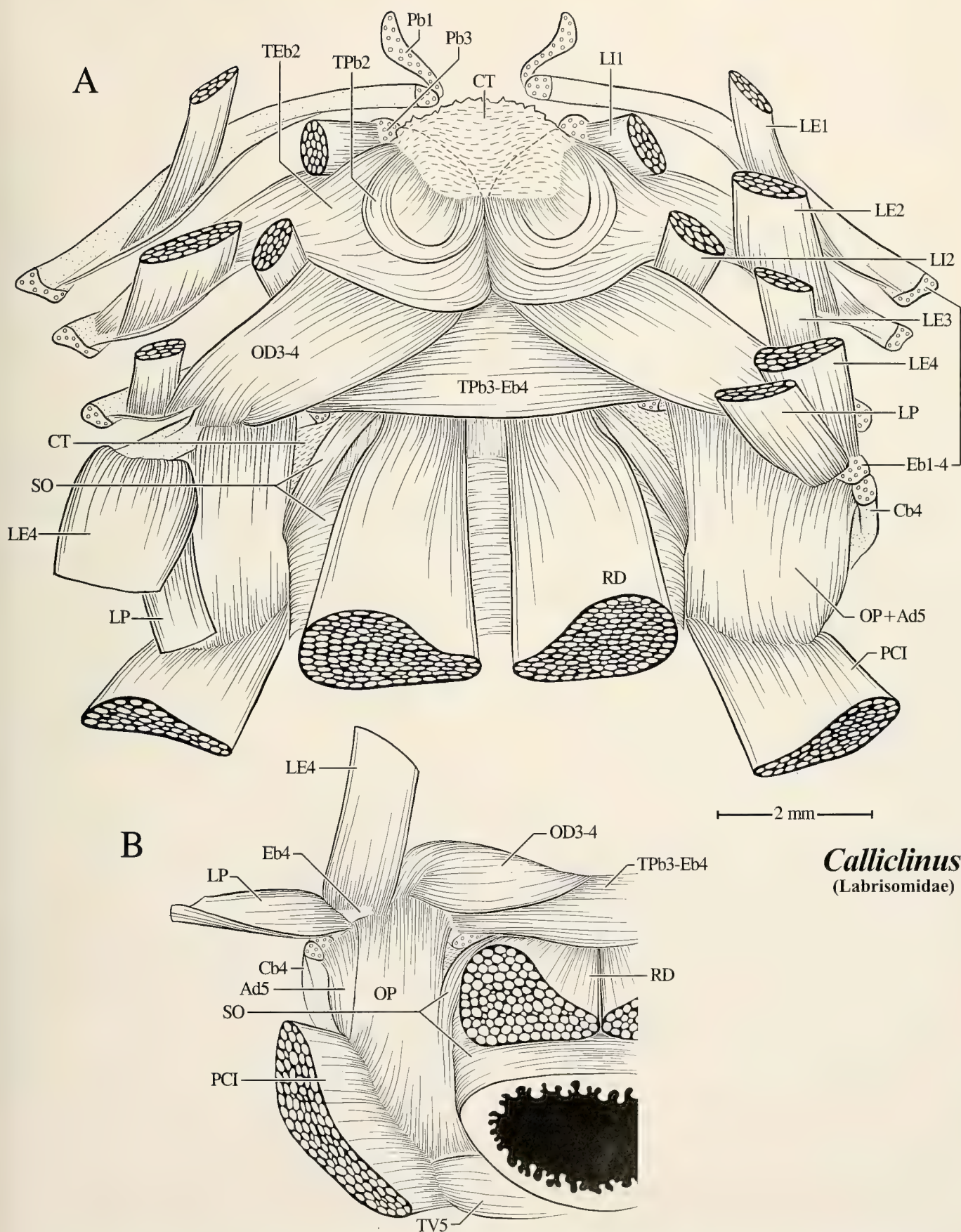


Plate 192. *Calliclinus geniguttatus*, USNM 369371: A, dorsal view, left-side LE4 and LP retracted posteriorly; dashed lines below anterior CT indicate anteromedial margins of Pb3s. B, posterior view, right side reversed, LP rotated clockwise, limits of Ad5 and OP from left side.





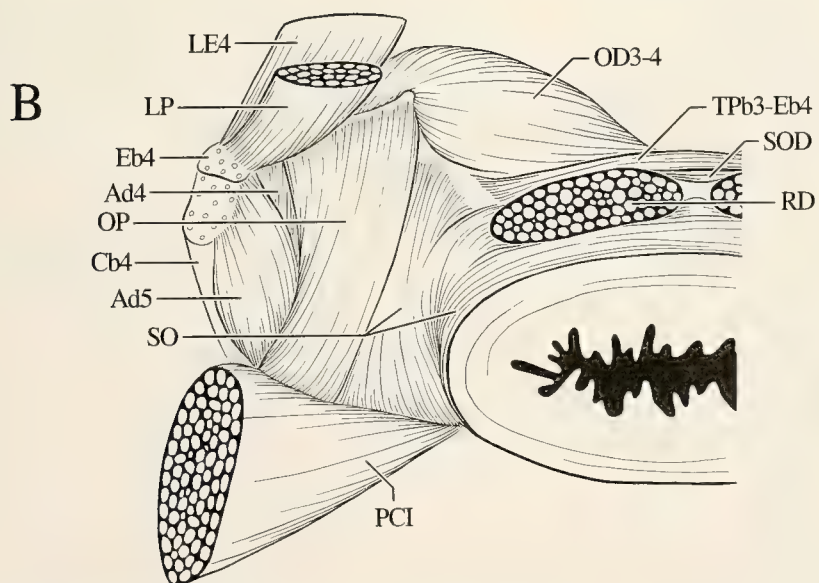
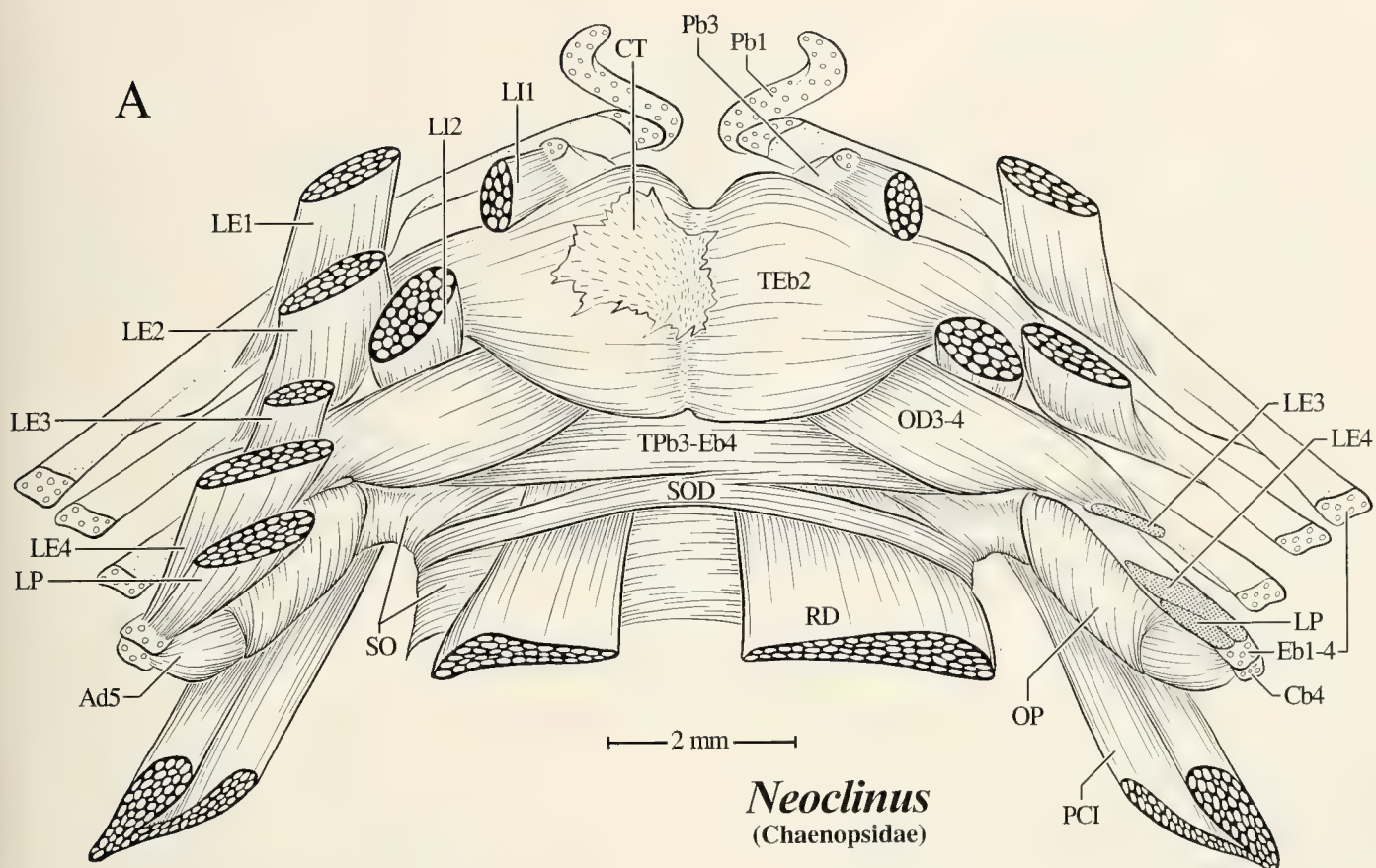
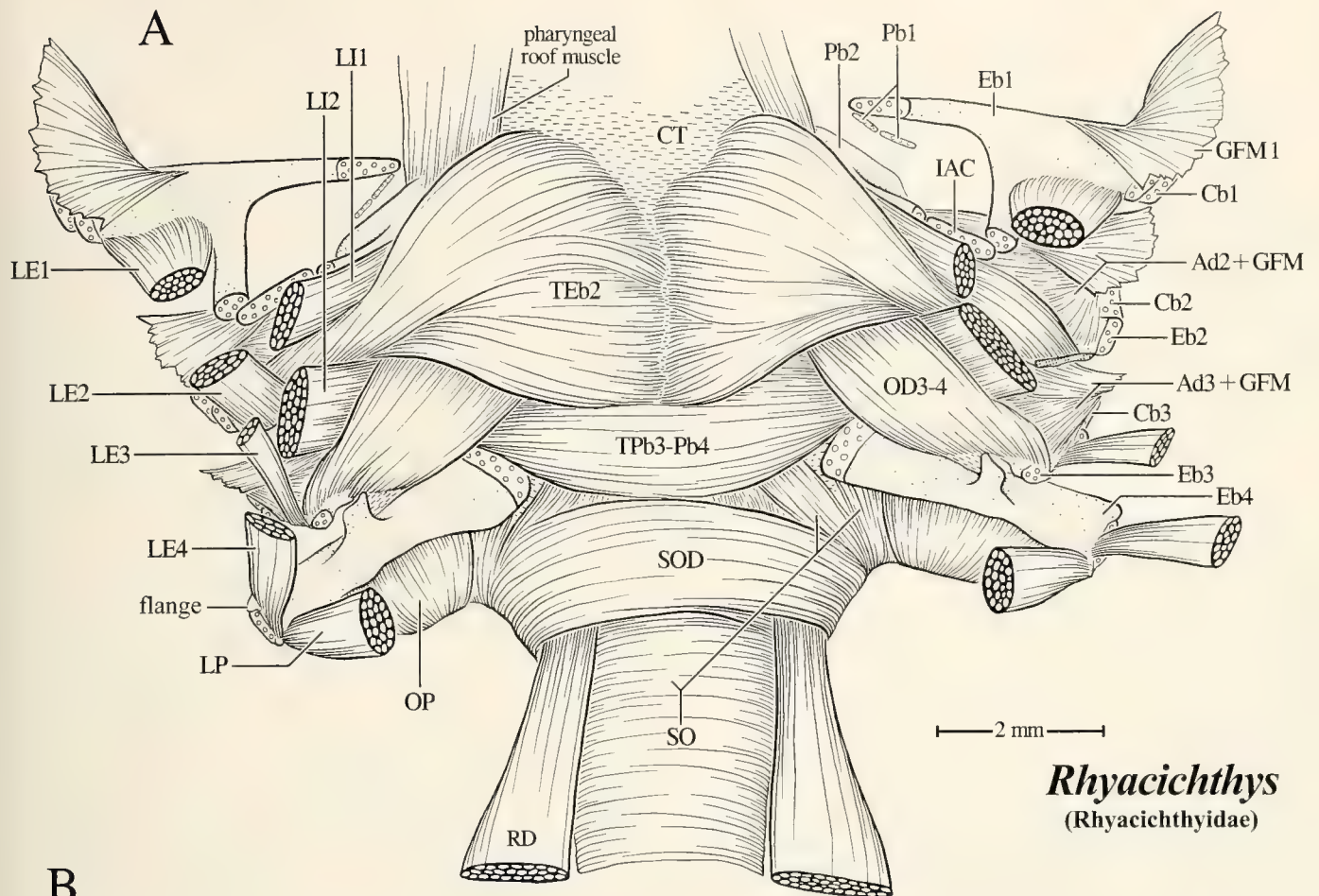
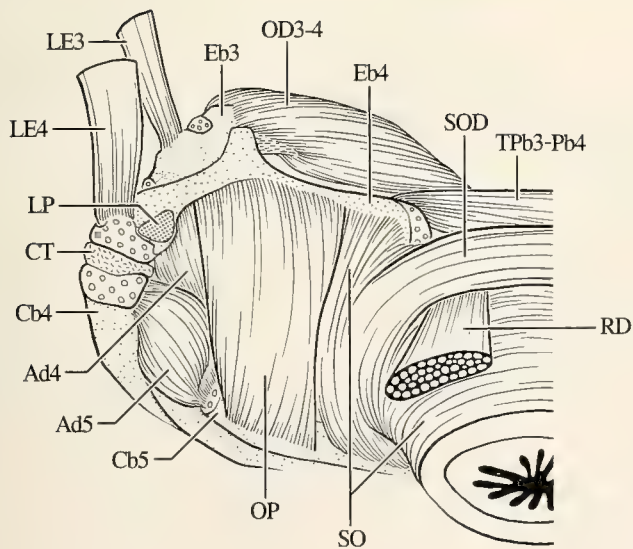


Plate 193. *Neoclinus blanchardi*, SIO 85-14: A, dorsal view, right-side LE3, LE4, and LP removed (insertion positions indicated by shading). B, posterior view, left side.





**B**



**C**

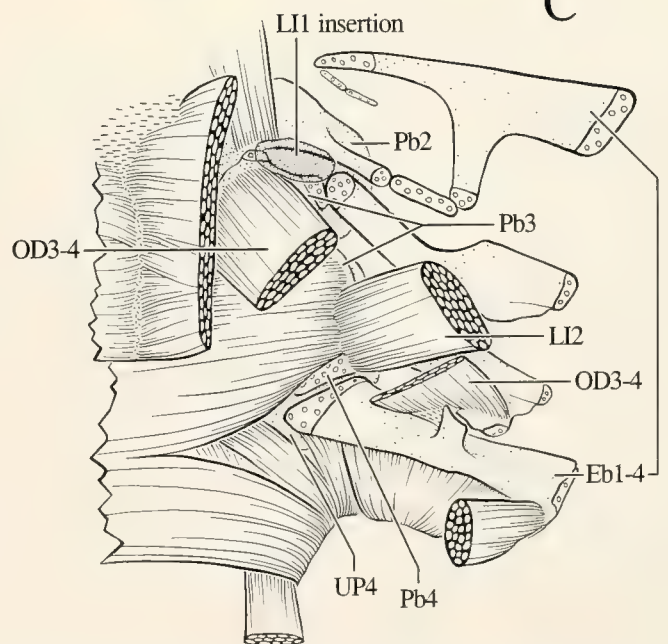


Plate 194. *Rhyacichthys aspro*, USNM 247300: A, dorsal view, right-side LE2 removed (insertion position indicated by shading), right-side LE3 and LE4 forced laterally. B, posterior view, LP removed (insertion position indicated by shading). C, dorsal view, right side, various muscles removed or cut away to show underlying muscle attachments, shaded area indicates LI1 insertion position.





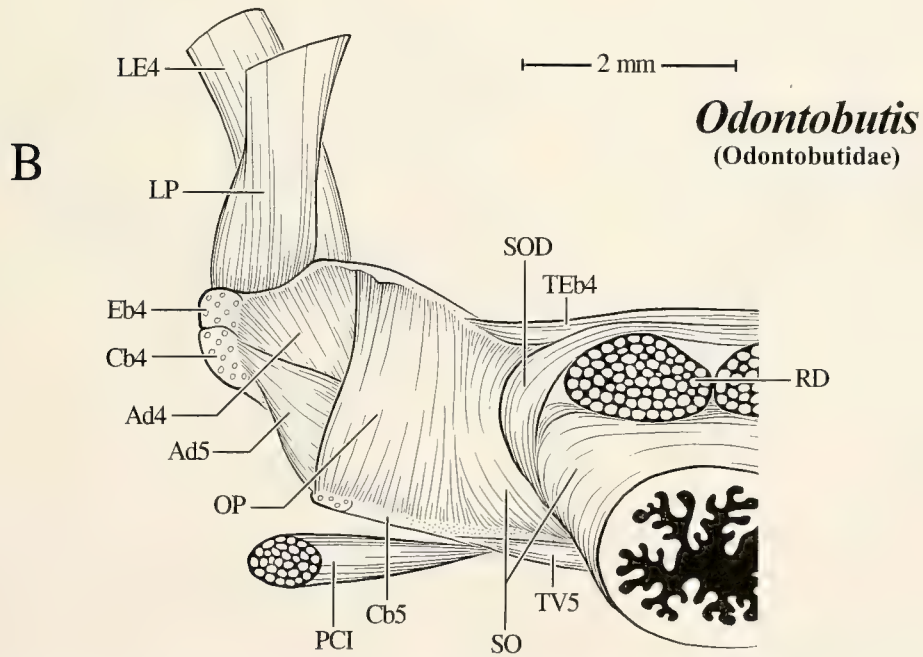
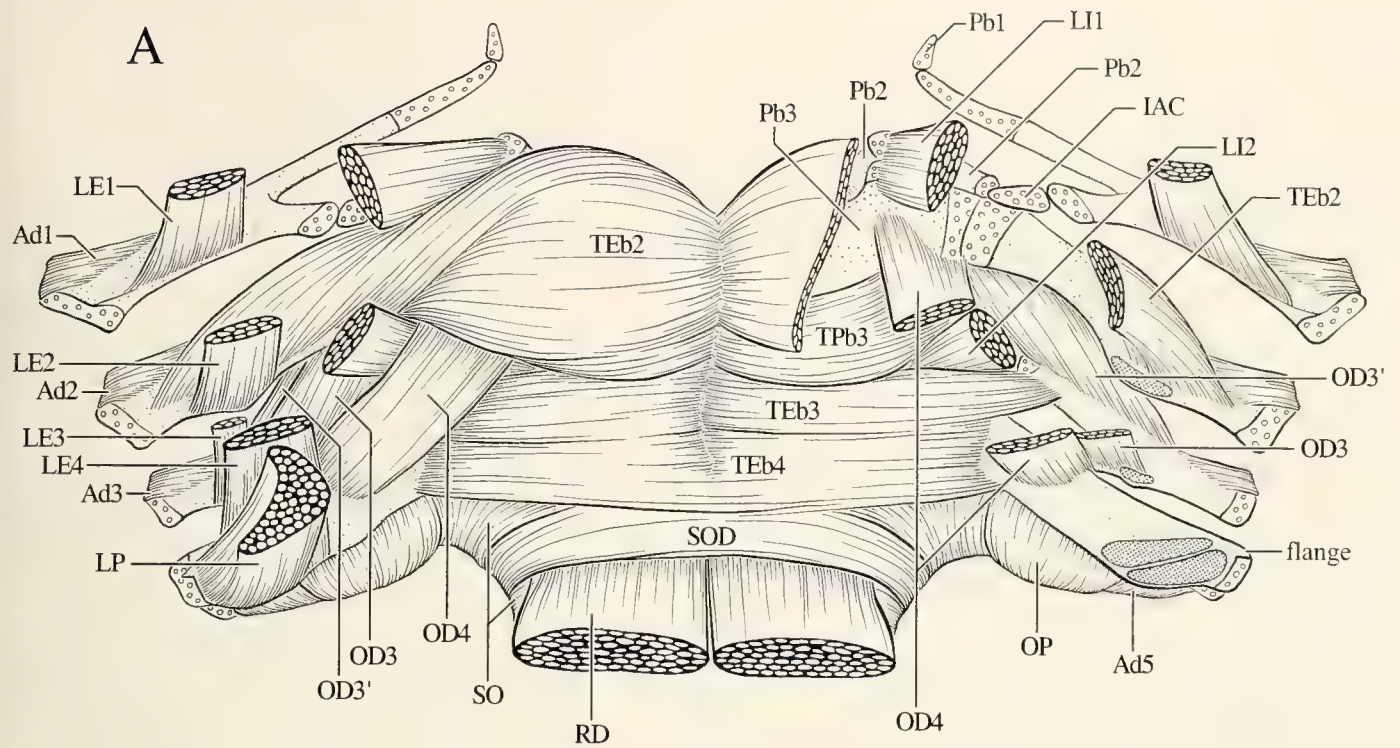


Plate 195. *Odontobutis obscura*, USNM 2648932: A, dorsal view, right-side TEb2, OD4, and OD3 cut away, right-side LE2, LE3, LE4, and LP removed (insertion positions shown by shading). B, posterior view, right side reversed.



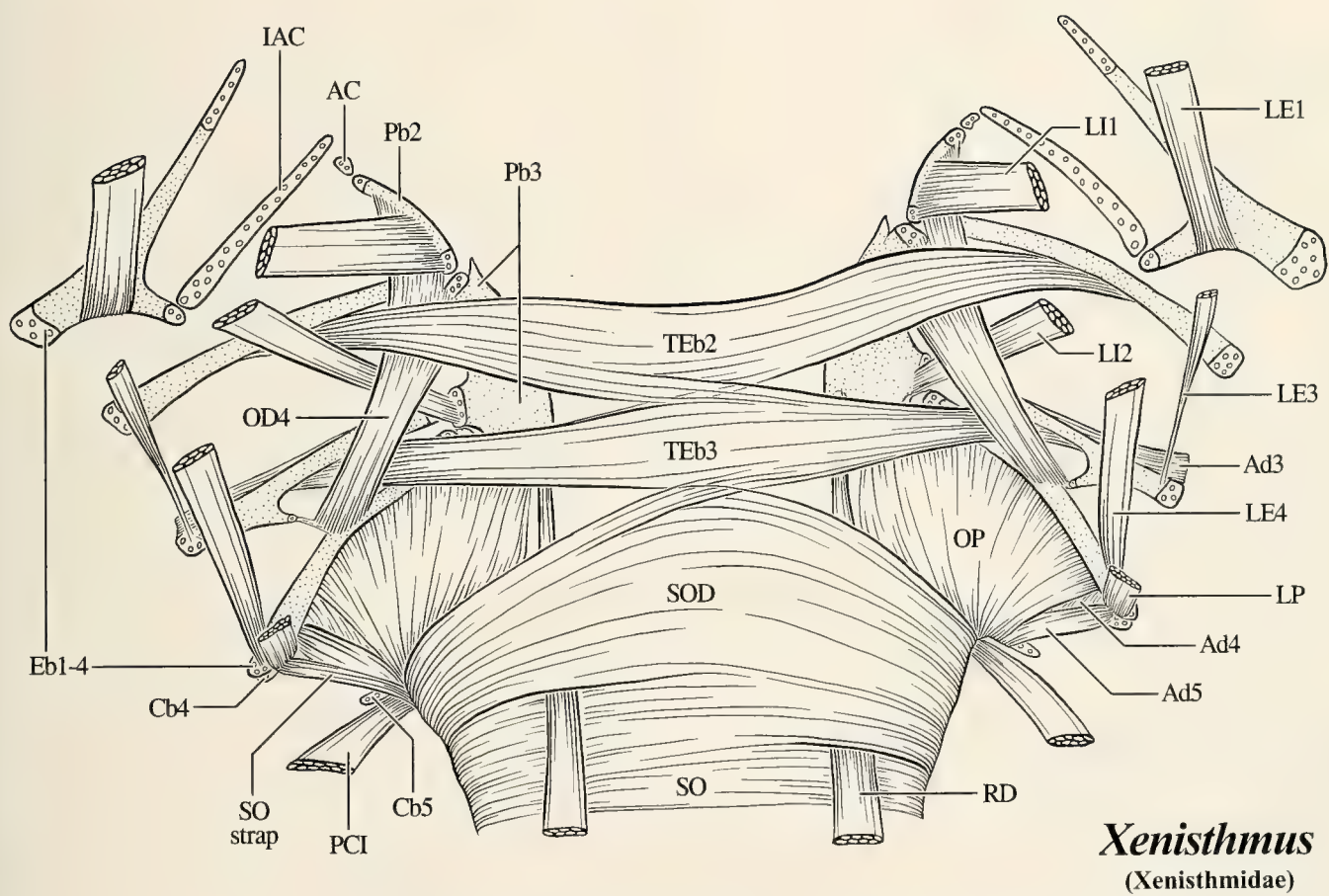
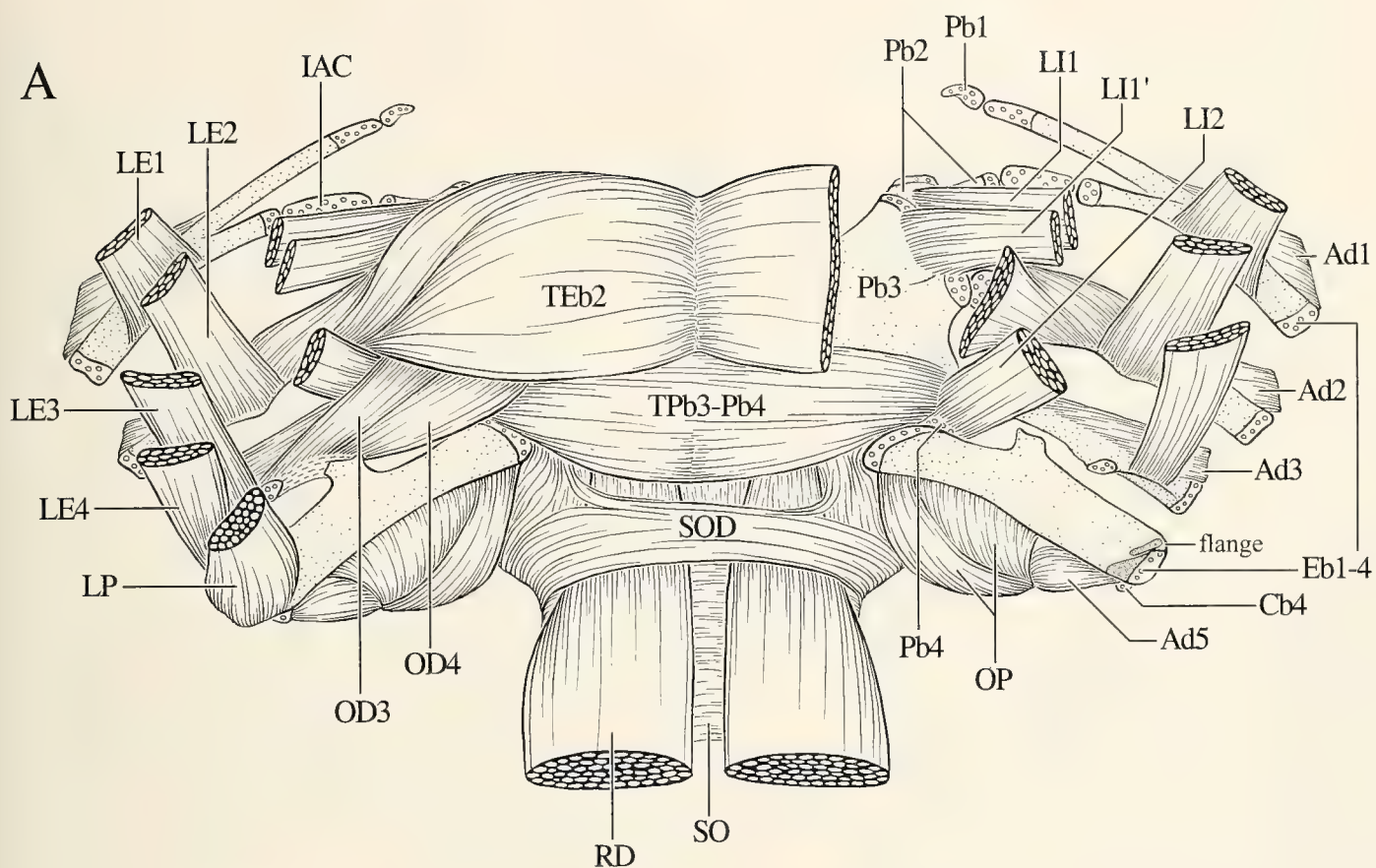


Plate 196. *Xenisthmus* sp., USNM 247389: dorsal view.







*Eleotris*  
(Eleotridae)

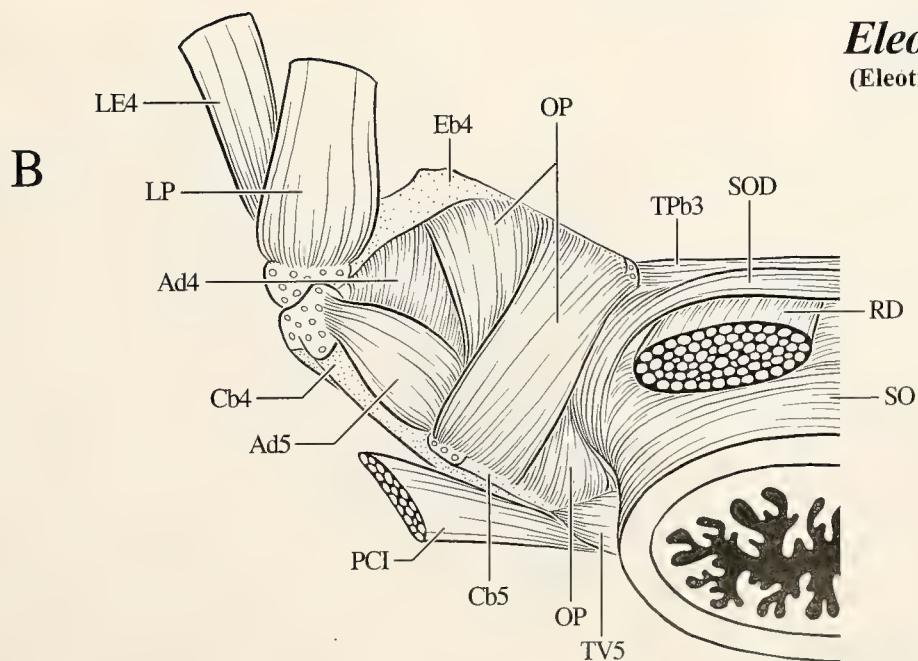
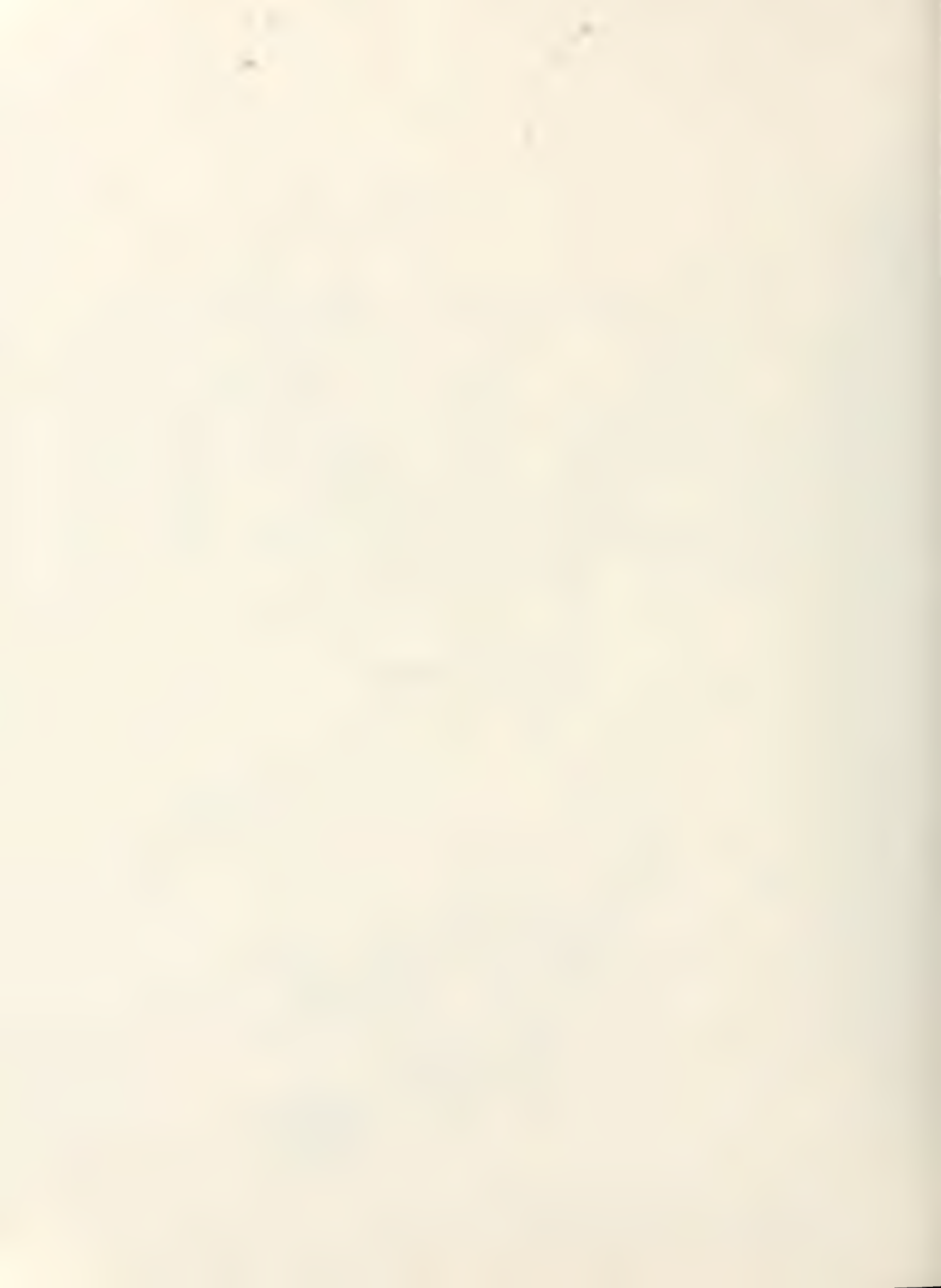


Plate 197. *Eleotris melanosoma*, USNM 321251: A, dorsal view, right-side TEb2 cut away, right-side OD3, OD4, LE4, and LP removed (insertion positions indicated by shading). B, posterior view, left side.



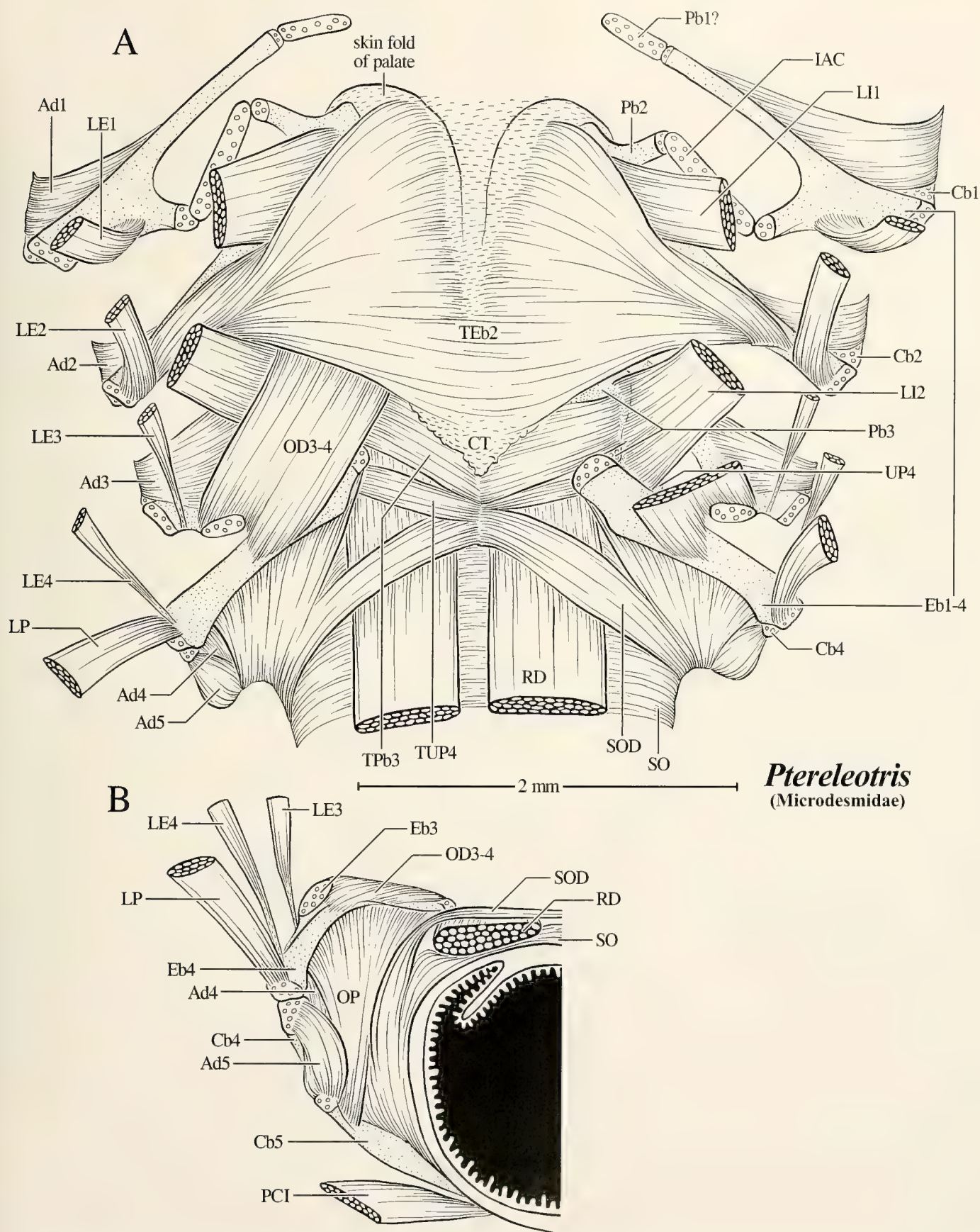


Plate 198. *Ptereleotris microlepis*, USNM 257075: A, dorsal view, left-side LP rotated posteriorly; right-side OD3-4 cut away to reveal LI2 insertion. B, posterior view, left side.





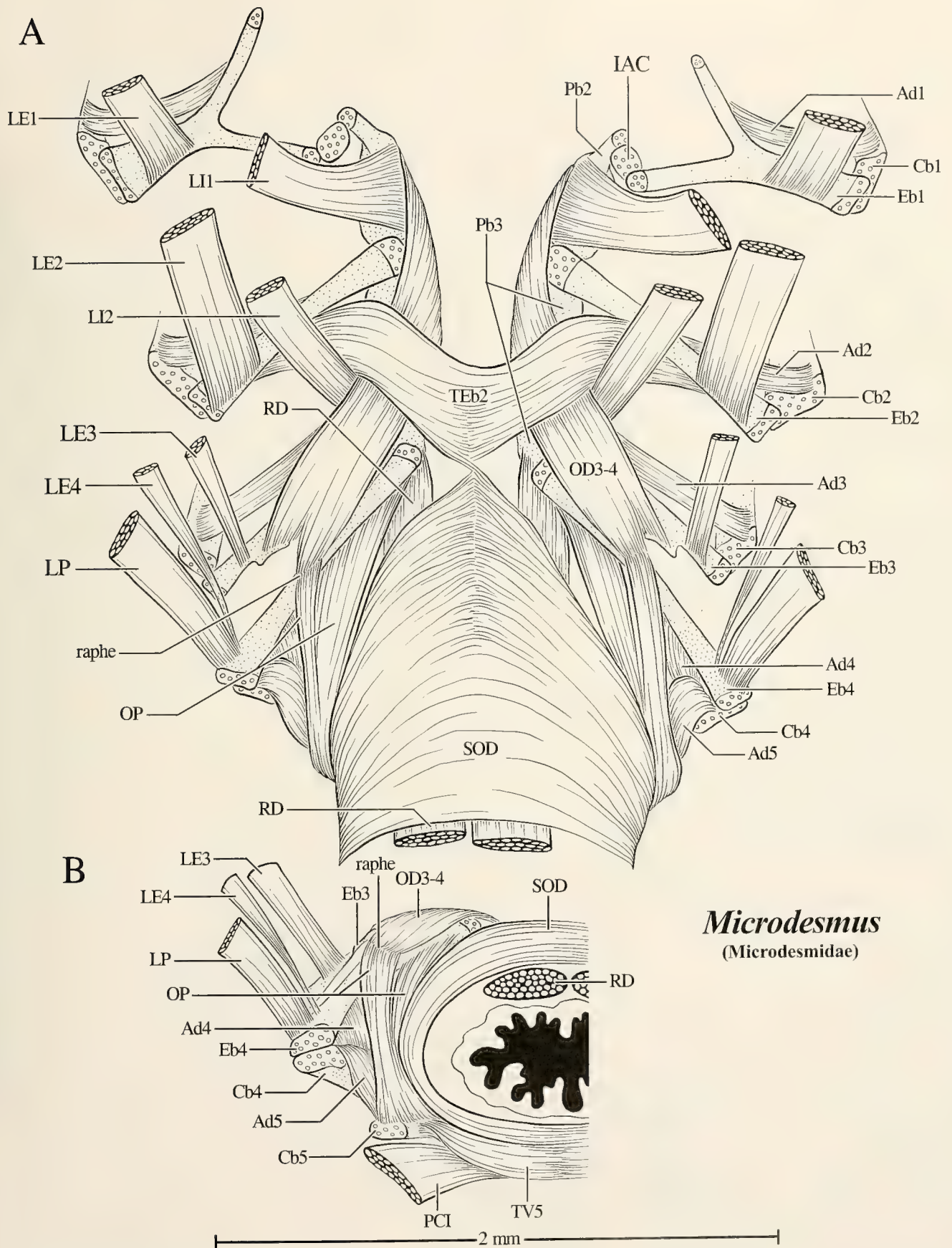
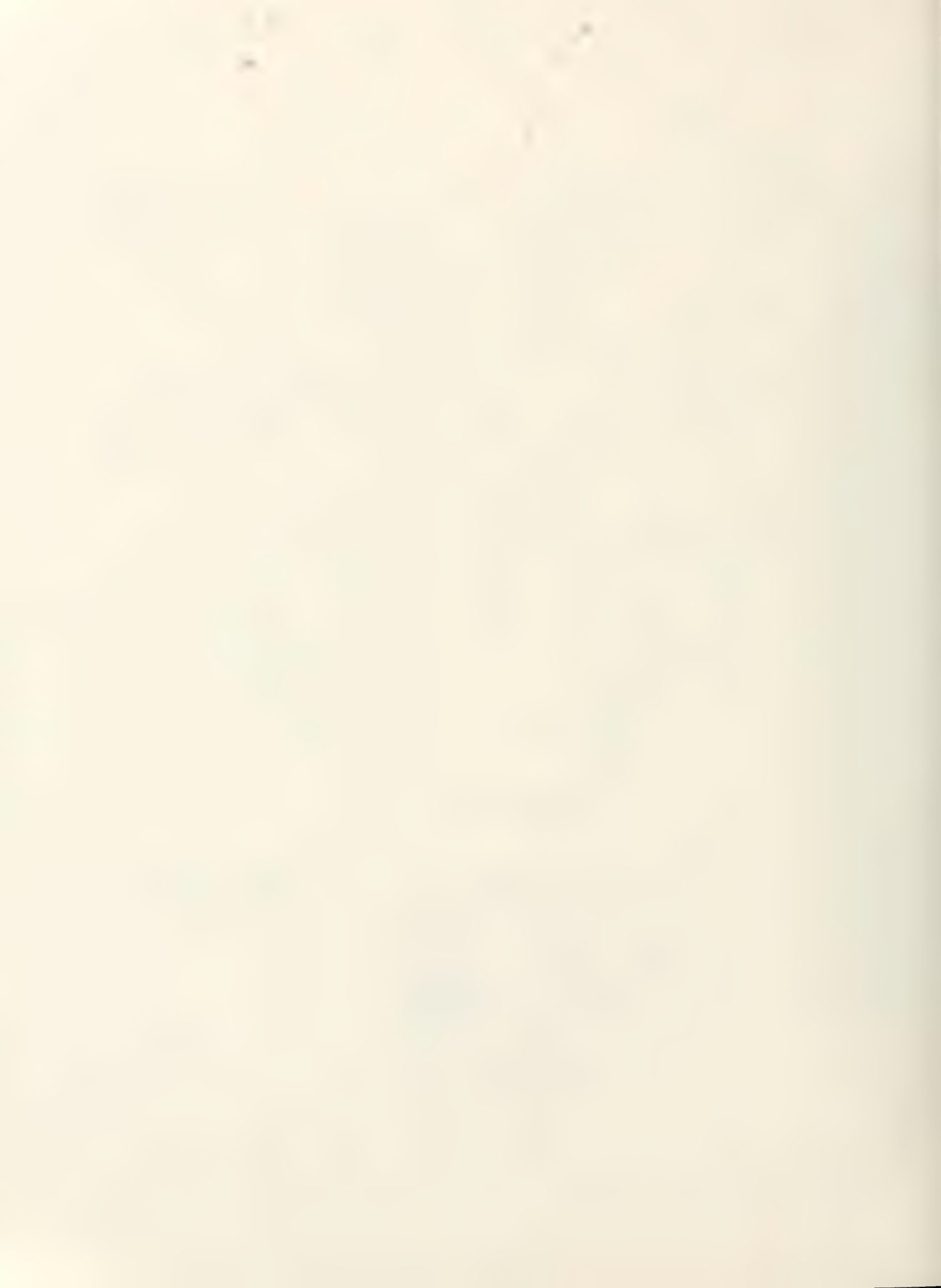
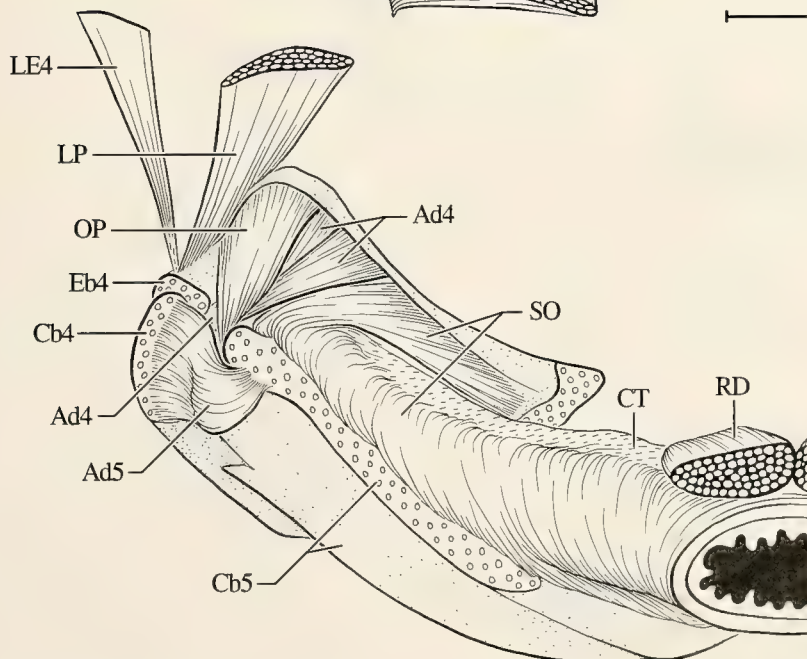
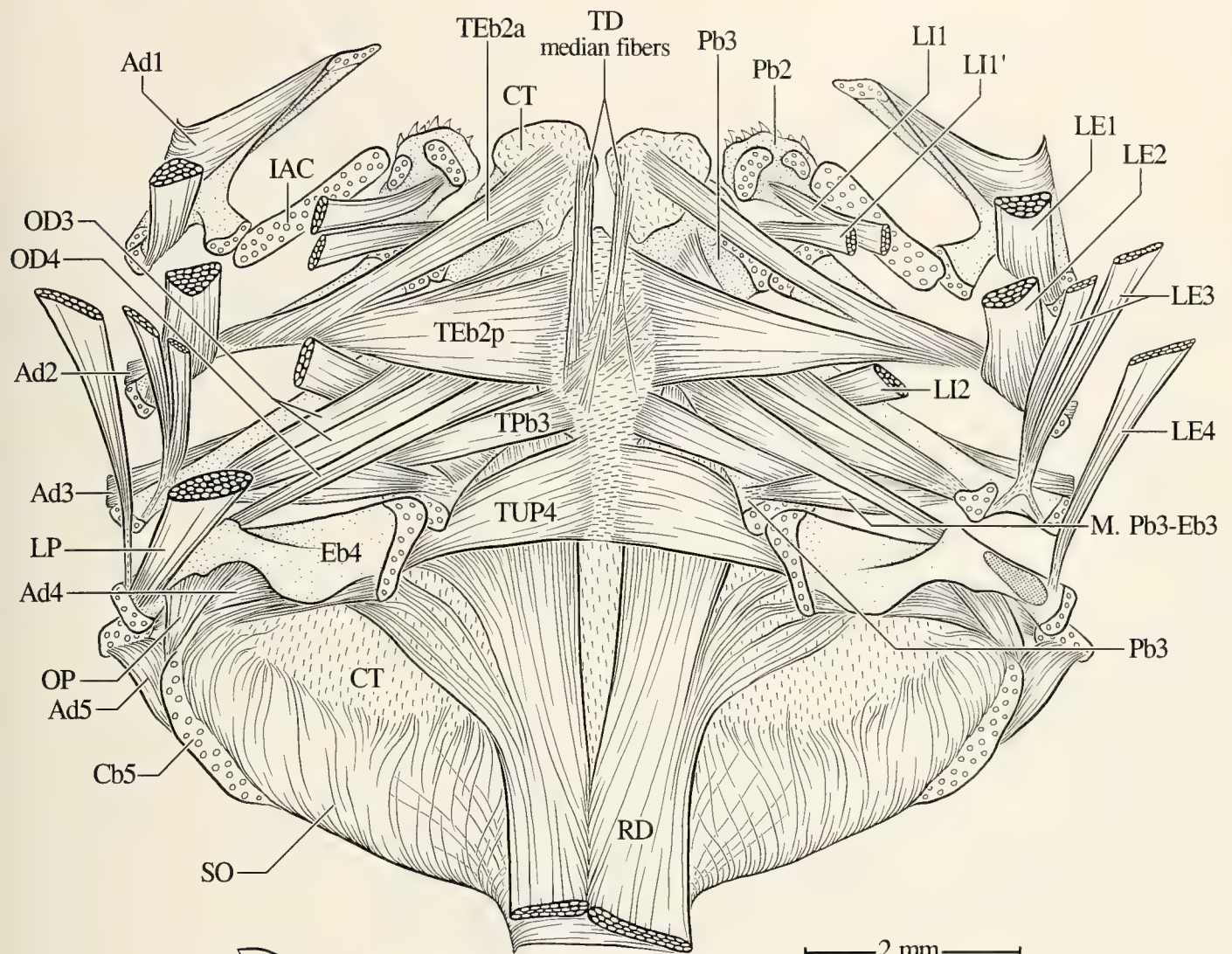


Plate 199. *Microdesmus longipinnis*, USNM 196614: A, dorsal view. B, posterior view, right side reversed.

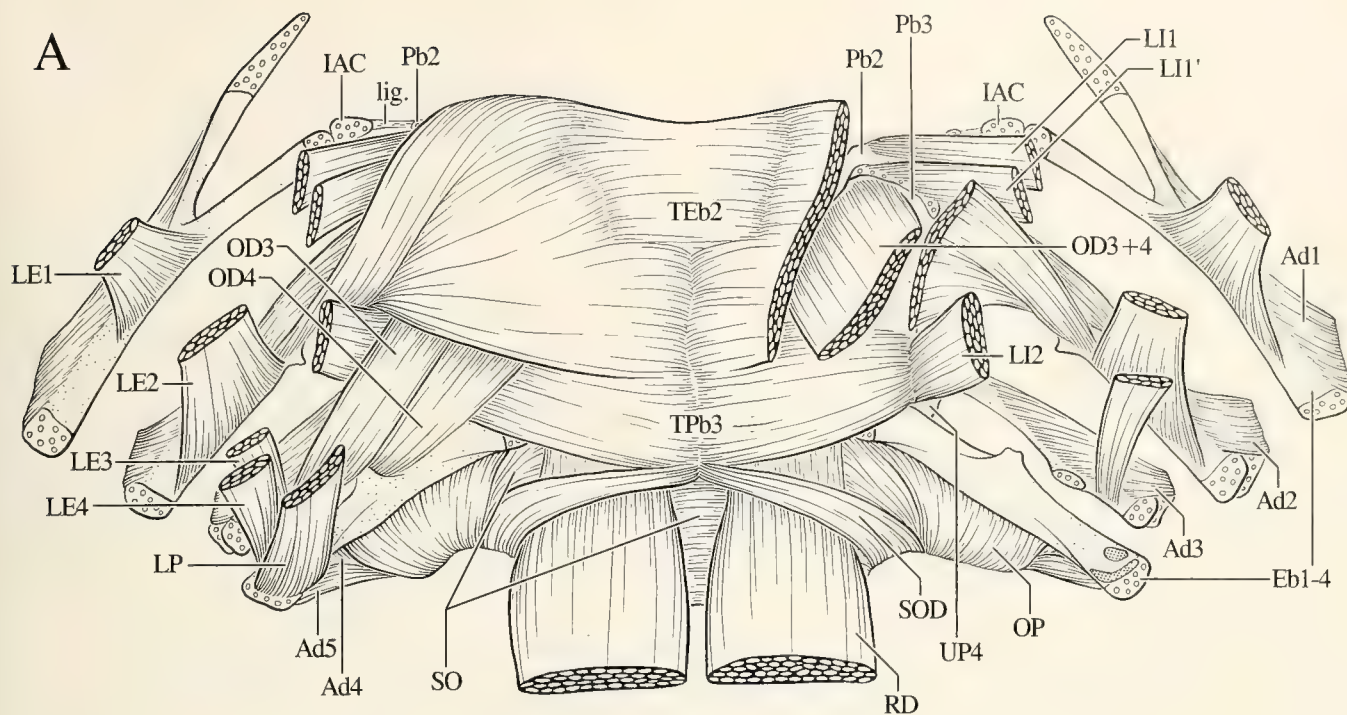




*Pseudapocryptes*  
(Gobiidae)

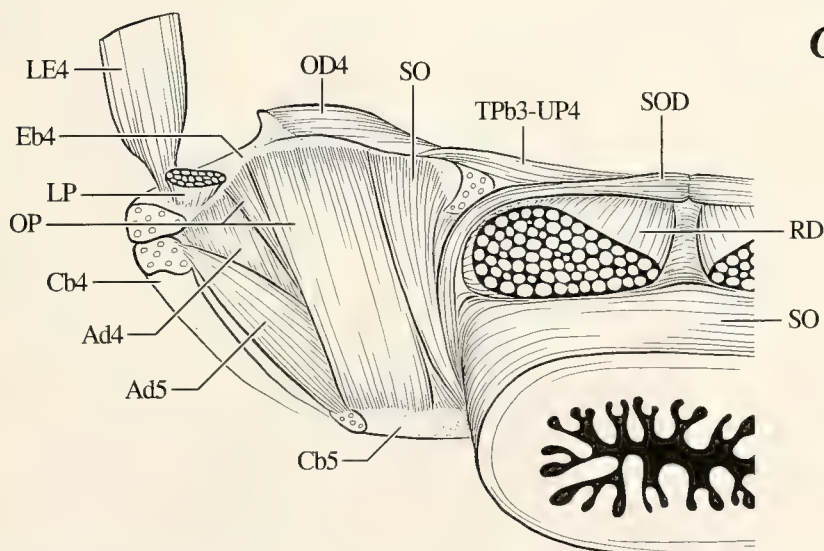






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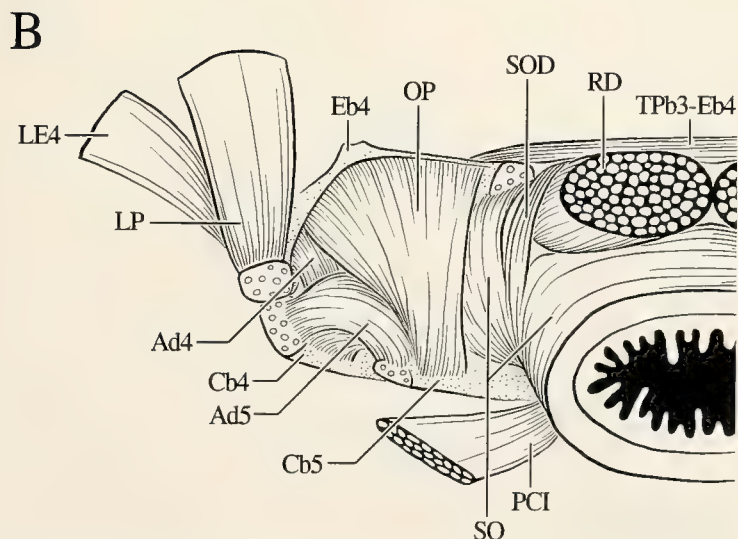
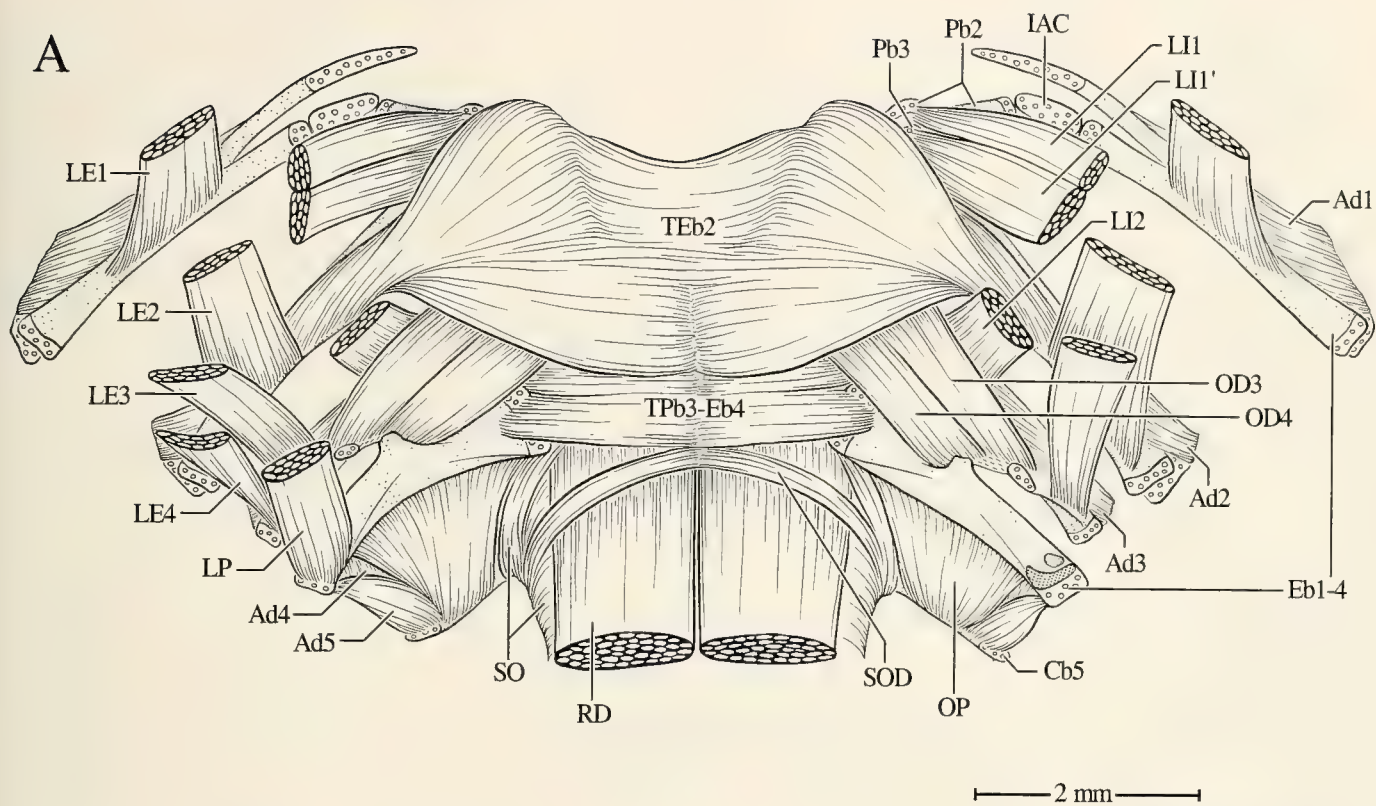
B



*Glossogobius*  
(Gobiidae)

Plate 201. A, B, *Glossogobius aureus*, USNM 241833: A, dorsal view, right-side TEb2 cut away to reveal IAC and LI2 insertion on Pb2 and Pb3, right-side LE4 and LP removed (insertion positions indicated by shading). B, posterior view, left side.

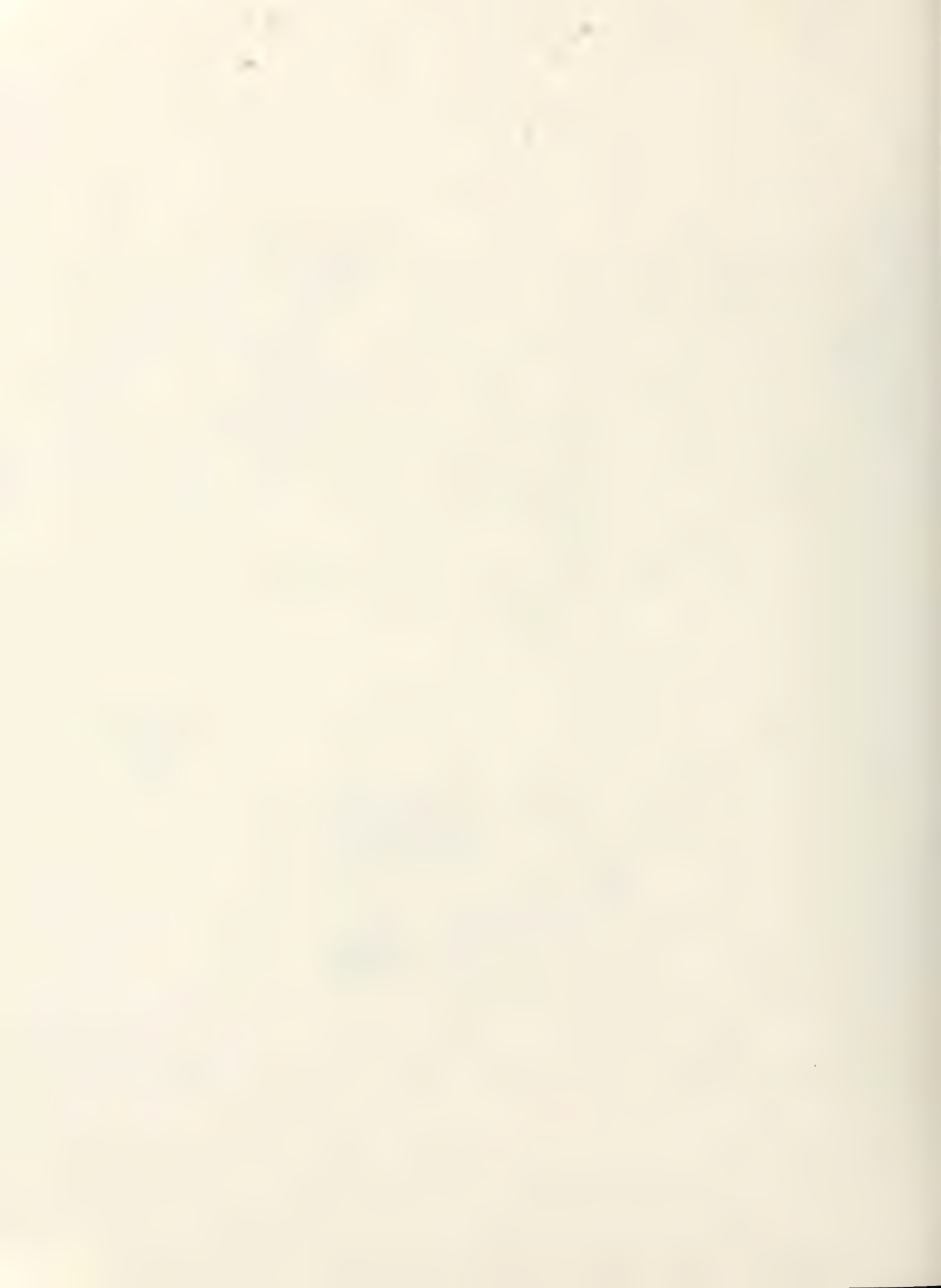


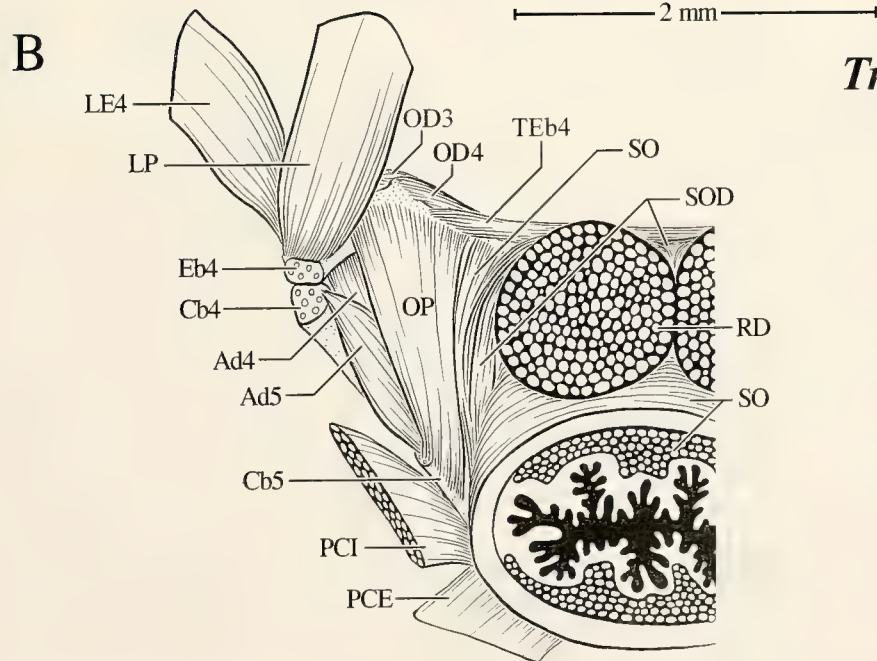
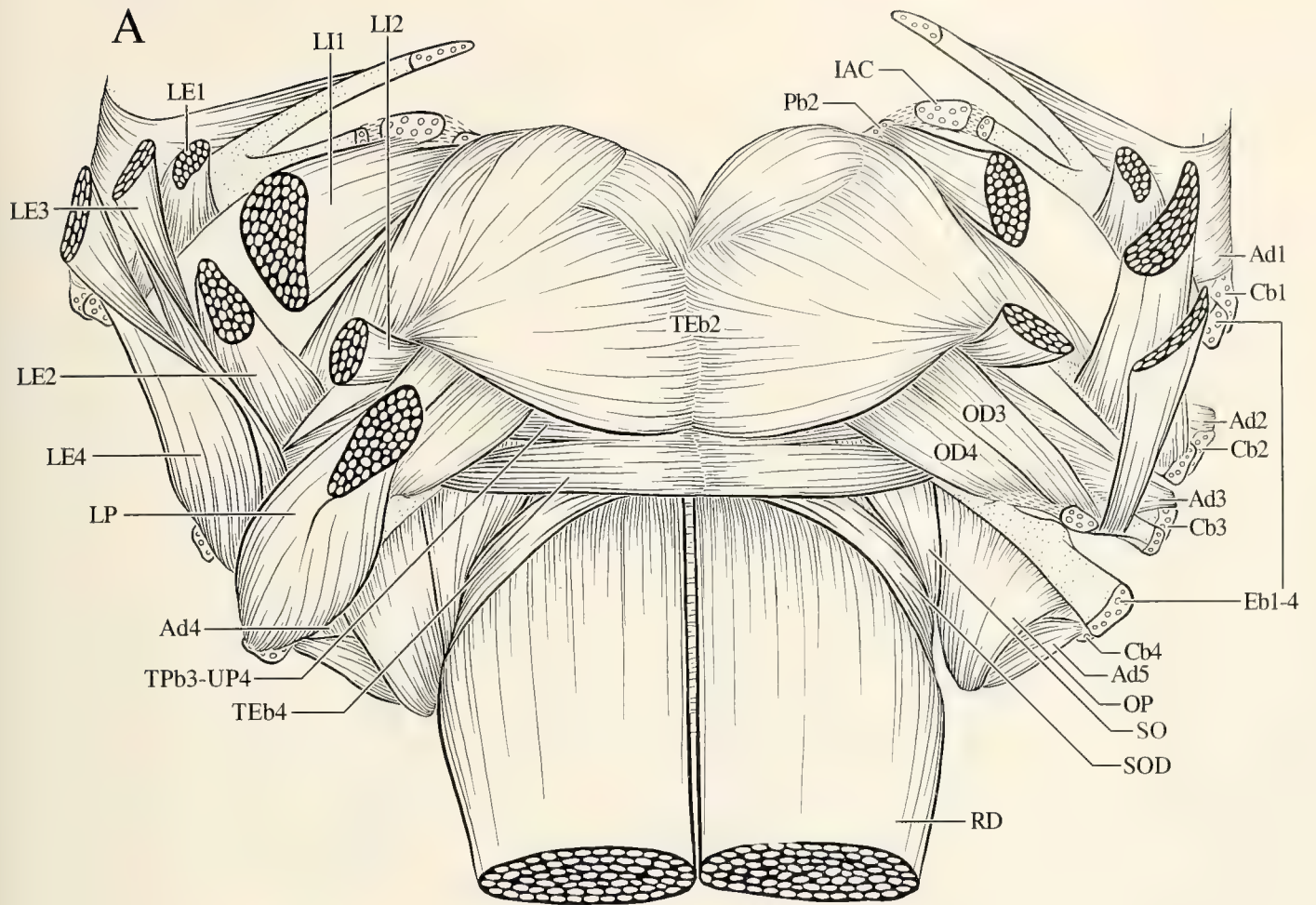


***Bollmannia***  
(Gobiidae)

Plate 202. *Bollmannia chlamydes*, USNM 342697: A, dorsal view, right-side LE4 and LP removed (insertion positions shown by shading). B, posterior view, left side.



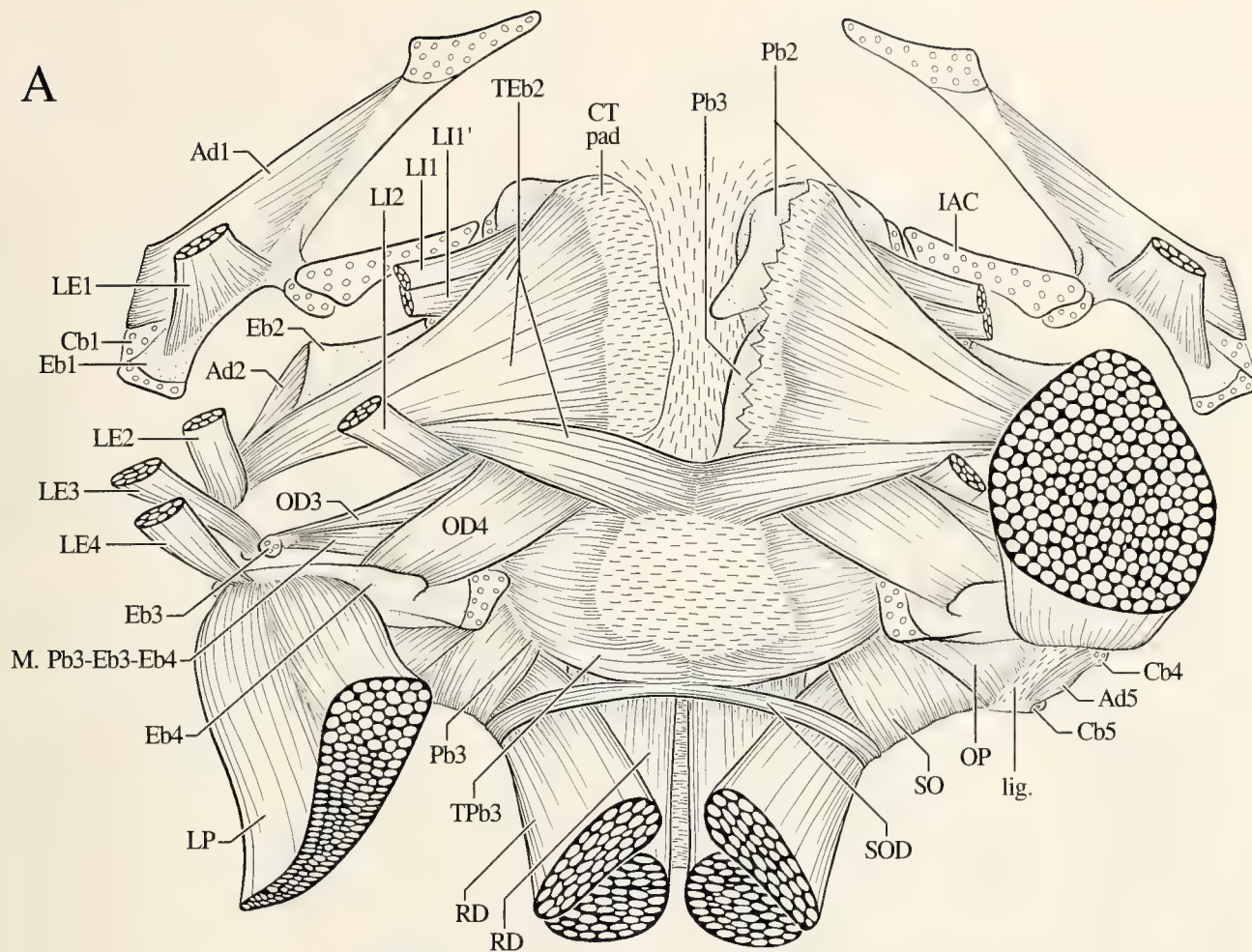




***Trypauchen***  
(Gobiidae)

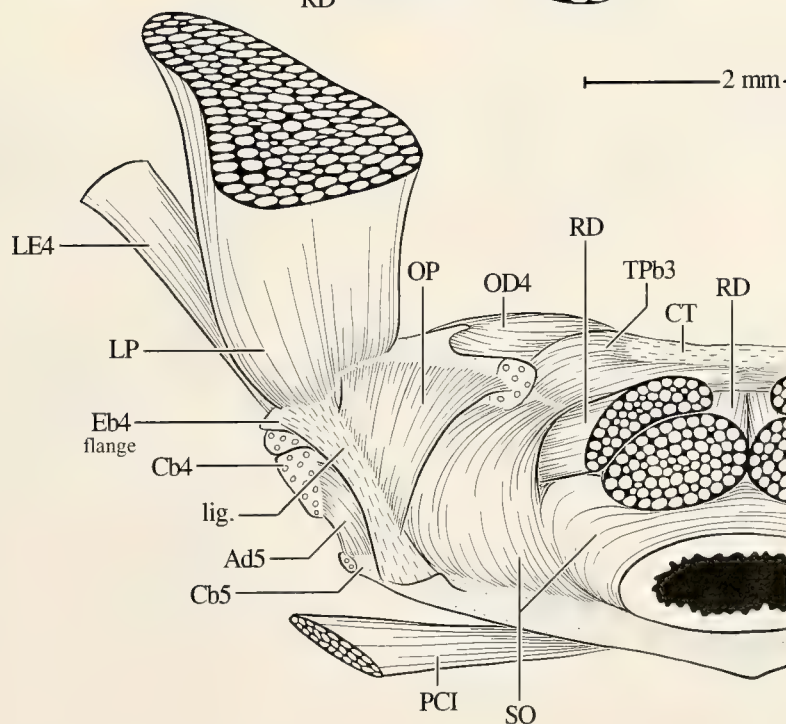
Plate 203. *Trypauchen vagina*, USNM 339608: A, dorsal view, right-side LE4 and LP removed (indicated left-side LI1 insertion on IAC is erroneous). B, posterior view, left side.





2 mm

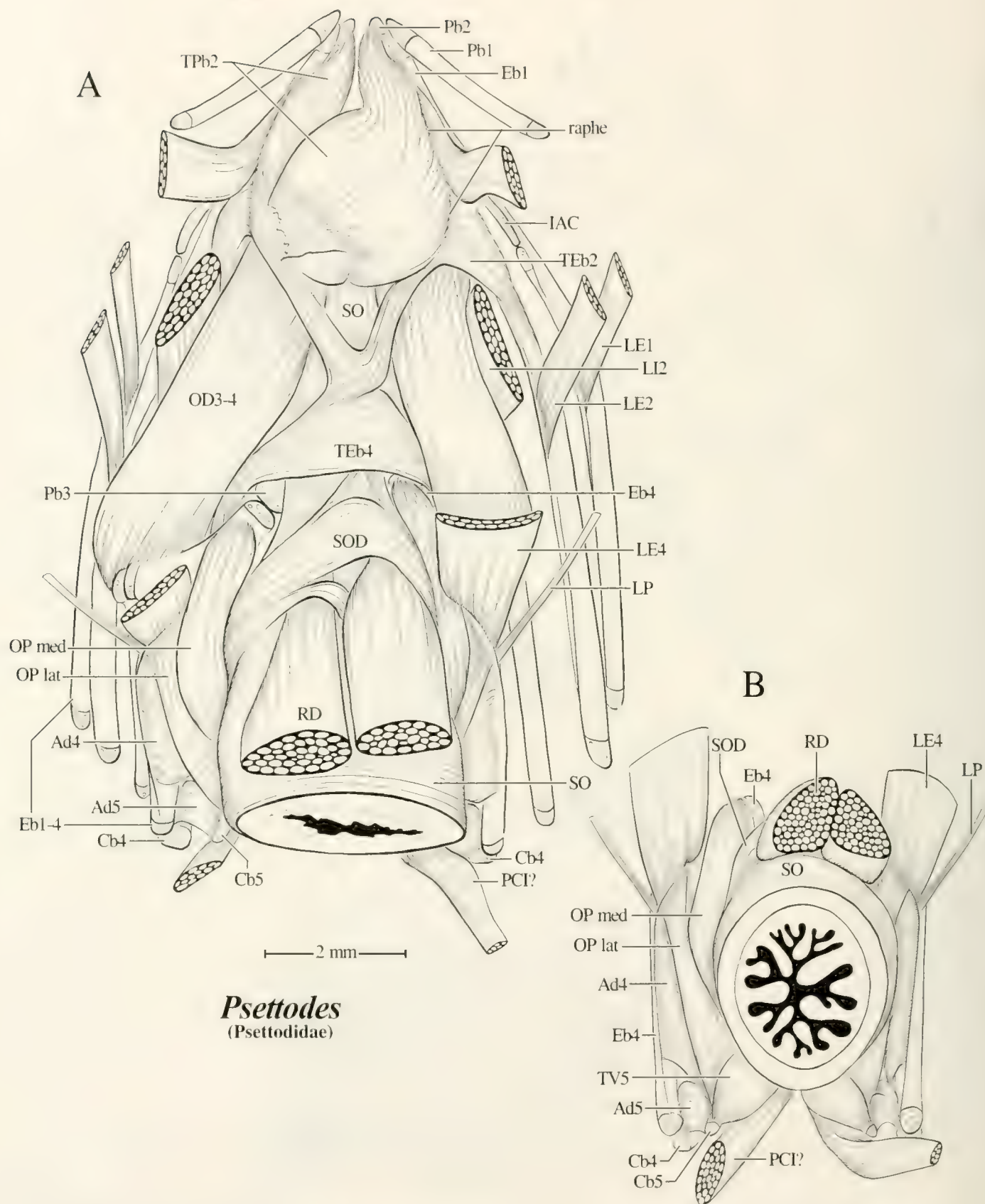
**B**



***Gnatholepis***  
(Gobiidae)

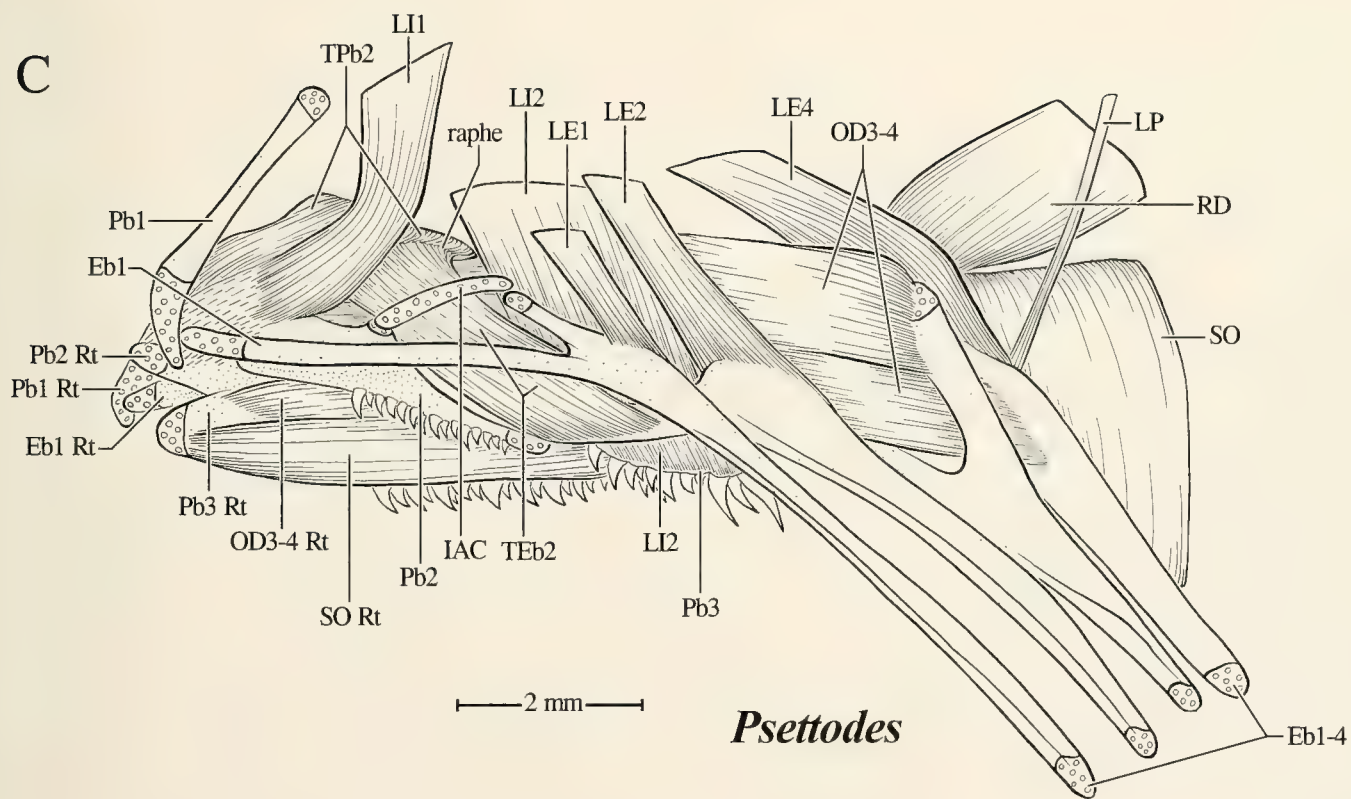
Plate 204. *Gnatholepis cauerensis*, USNM 327750: A, dorsal view; left-side LP rotated posteriorly to reveal underlying muscles, right-side CT pad cut away to reveal underlying Pb2 and Pb3 facets. B, posterior view, left side, LP and OP attach to ligament extending from Eb4 to Cb5.





Plates 205.1, 205.2. *Psettodes erumei*, USNM 366443 (eyes on left side): A, dorsal view. B, posterior view. C, lateral view, left side, all right-side (Rt) elements indicated.

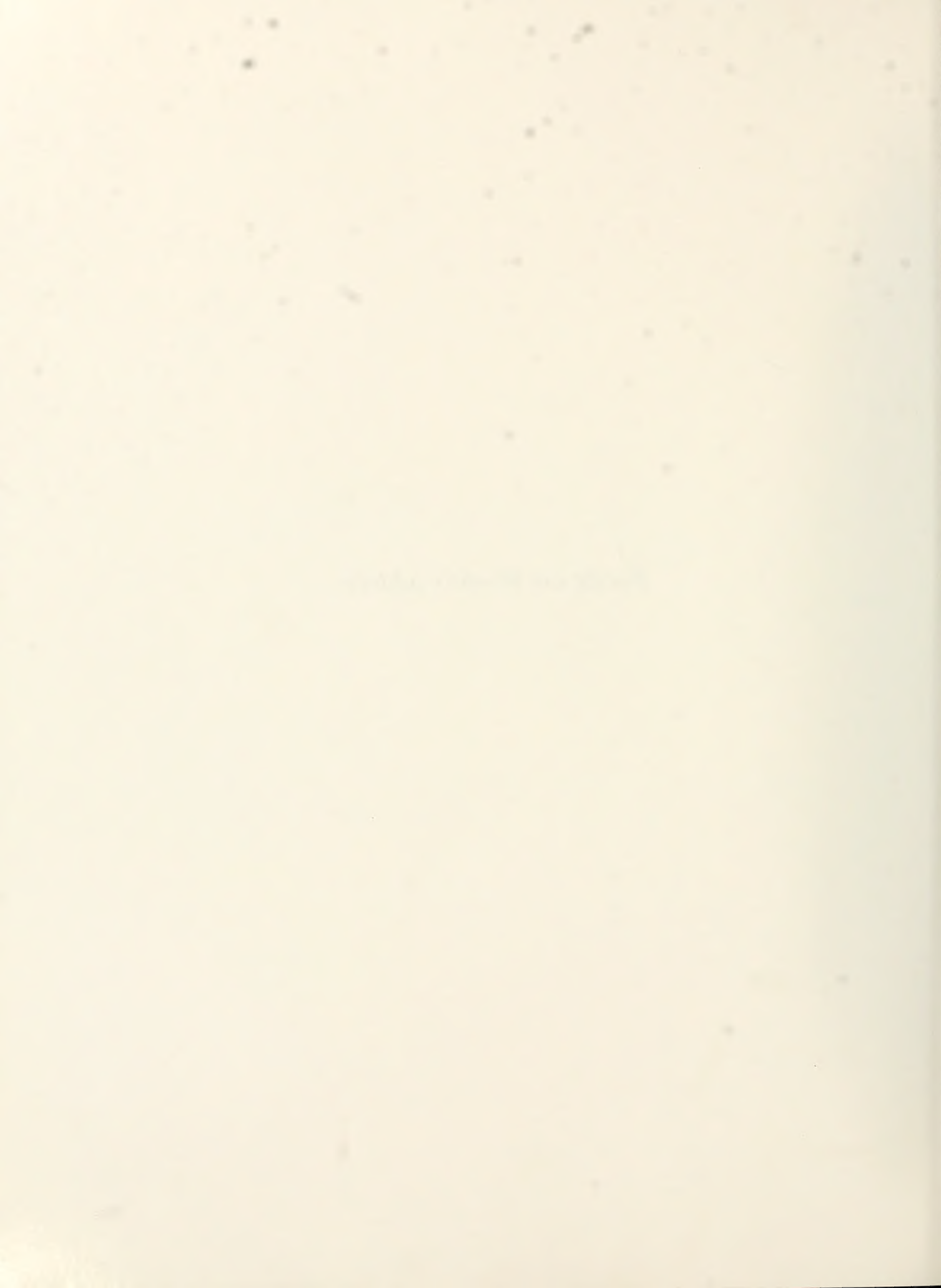
C





*Facile est inventis addere*







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